QUANTIFICATION OF RISK FOR USAF FIRE AND EMERGENCY SERVICES FLIGHTS AS A RESULT OF SHORTAGES IN MANPOWER

THESIS

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Abstract

The United States Air Force (USAF) is currently experiencing a period of high operations tempo and overseas deployments have become frequent. These deployments will leave home installations short manned. Some amount of risk is incurred by the home installation as a result of the short manning. For an organization, such as an USAF Fire and Emergency Services (FES) flight, whose primary responsibility is the protection of life and property, the incurred risk could be catastrophic. Still no attempt has been made to quantify risk in terms of manpower for USAF FES flights.

The primary purpose of this research was to develop and validate a methodology to quantify risk in terms of manpower for FES flights. This research develops a decision tool to provide insight to FES Fire Chiefs on the risk associated with specific manpower decisions. The methodology was validated using data from Dyess Air Force Base FES flight. A secondary goal of the research was to determine a cost/benefit relationship between the risk level and the cost to backfill deployed firefighter positions with contract labor. The result was a decision tree model and pareto optimal graphs for the risk to manpower level and the cost/benefit relationship.

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Dedicated to mom and dad who have always been my heroes and my role models

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I would like to extend a very special thank you to my parents, family, and friends. Without their moral support, proof reading skills, and other selfless acts, this thesis would not have been possible. Thank you for always being there.

Timothy (Damon) Dalby

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QUANTIFICATION OF RISK FOR USAF FIRE AND EMERGENCY SERVICES FLIGHTS AS A RESULT OF SHORTAGES IN MANPOWER

I. Introduction

Background

Emergency services play a vital role in the safety of a community as the first responders to emergency or potential emergency events. In this role of first responders, emergency services personnel are expected to maintain a certain level of public safety and minimize the material costs of an incident. Each day emergency services' decision makers are faced with manpower decisions. Most of these manpower decisions are intended to minimize cost while keeping risk at an acceptable level. This decision can be made tougher by manpower absences, both scheduled and unscheduled, because the role first responders serve for the community still exists. United States Air Force (USAF) Fire and Emergency Services (FES) flights have the same manpower concerns as civilian emergency services, but they are also faced with some manpower concerns unique to military organizations. One unique concern is supporting worldwide deployments. These deployments may be known in advance or may come with little warning. Deployments can create tough manpower decisions for USAF fire chiefs and leadership.

In most municipalities there are three main services first responders provide. These services are fire department, police department and emergency medical services.

The New York Police Department (2007) defines its mission as "to enhance the quality of life in our City by working in partnership with the community and in accordance with constitutional rights to enforce the laws, preserve the peace, reduce fear, and provide for a safe environment." Brotcorne et al. (2003) defined emergency medical services as providing emergency medical treatment or paramedics for a variety of medical situations. Webster (2007) provides a basic definition of a fire department as "an organization for preventing or extinguishing fires." However, in many cases the role of the fire department is much greater than that definition. The USAF, in Air Force Instruction (AFI) 32-2001 (1999), defines the mission of an FES flight to be:

> The mission of Air Force Fire Protection is to provide fire and emergency services to prevent and minimize losses to Air Force lives, property, and the environment occurring in periods of peace, war, military operations other-than-war, and humanitarian support operations. These include both man-made and natural incidents requiring fire protection, rescue, hazardous material, and emergency medical responses

The USAF definition is similar to other fire department definitions. This definition creates a situation where the fire department is a responder to almost all emergency responses outside of normal law enforcement responses. As of late, emergency services have been tested even more with monumental natural disasters and a growing population. In addition, emergency services have seen their responsibilities increase as the emphasis on homeland security increases. The Fire Reshaping Conference (2006) suggested the final sentence of the mission be changed to:

> Included are both man-made and natural incidents; fire suppression or hazard mitigation; rescue; mitigation or containment of releases of hazardous materials, such as chemical, biological, radiological, nuclear, or explosive (CBRNE) agents, resulting from industrial accidents, terrorism, or weapons of mass destruction (WMD); and emergency medical services…

In addition to having the same problems as the municipalities, FES flights also have responsibilities to the Global War on Terror and other USAF overseas operations.

The USAF experiences a continual cycle of overseas deployments as part of the Air and Space Expeditionary Force (AEF). Jumper (2005) states the AEF consists of ten combat units that are deployed for 120 days every 20 months. The AEF cycle temporarily relocates airmen from their home installations to forward operating bases. However, some specific units or entire combat units may be required to deploy longer than 120 days or more frequently than every 20 months (Jumper, 2005). The AEF cycle can lead to a manpower shortage at home installations, creating an increased risk to the home installation’s mission. The effect on the mission is particularly evident when analyzing public safety flights such as USAF FES flights. FES flights are still required to maintain adequate home installation coverage to sustain the mission throughout the deployment.

Air Force Manpower Standard (AFMS) 44EF (1996) currently governs the manpower level in FES flights. The standard creates a baseline FES manpower standard package which is defined for manpower and equipment. The FES manpower baseline is 55 firefighters with the exception of six bases with special or reduced responsibilities. According to AFI 32-2001 (1999), manpower levels are to be based on the assumption that only one major aircraft, structural, or hazardous material incident will occur simultaneously. AFMS 44EF (1996) was established to provide enough manpower to support wartime and peacetime, however, manpower is not adjusted based on the actual manpower deployment rates at an installation.

AFMS 44EF (1996) states manpower and equipment will be either added or subtracted in accordance with the following items:

1. Fire Flow Demand (In intervals of 3,000 gallons per minute demand)
2. Minimum Response Times Cannot be Met
3. Installations with Permanently Assigned Large Aircraft (Over 175 feet in Length)
4. Installations with Auxiliary Flying Fields
5. Installations with Gunnery/Bomb Range or Offsite Weapon Storage
6. Installations without Flying Missions
7. Installations with Large Land Areas are Authorized Additional Fire Inspectors

Note: Major Commands (MAJCOM) can request additional firefighters if they determine there is a large enough presence of aircraft not permanently assigned to the installation to require such an action.

In order to keep the home installation mission operational during times of deployments, FES flights are requiring personnel to work overtime and/or hiring contractors to backfill the shortfalls. This can be at great expense with civilian overtime or contractor labor and lead to retention problems and lowered morale for the military firefighters (FES Reshaping Conference, 2006). However, understaffing an FES shift can also have negative consequences. Understaffing can cause loss of life or property and ultimately result in either mission failure or stoppage. Because of the severity of the consequences, it is important to understand the risk created to a base prior to deployment of its airmen.

During times of short manning, FES fire chiefs are required to develop an installation commander-approved risk assessment. AFI 32-201 (1999) states a risk assessment is necessary when an FES flight does not meet Department of Defense, Air Force, Occupational Safety and Health Administration (OSHA), or National Fire Protection Association (NFPA) standards. AFI 90-901 (2000), Air Force Pamphlet (AFPAM) 90-902 (2000), and Air Force Policy Directive (AFPD) 90-9 (2000) give basic guidance on operational risk assessments, but these do not limit the subjectivity of the analysis. In addition, a matrix developed by Air Combat Command (ACC), relates manpower level to impact. However, this matrix, depicted in Table 1.1, is not installation specific and may not be applicable to deployment situations.

Problem Statement

This research developed the methodology for a decision tool to allow FES fire chiefs to quantitatively analyze the risk associated with manpower shortage situations caused by deployments. Existing risk assessment methodology was modified as necessary to assess the risks at different manpower levels. In addition to quantitatively comparing risk, the cost/benefit associated with the manpower levels was analyzed. In the process, a collectively exhausted list of risk scenarios and their associated likelihood and consequence will be developed. USAF installations have a unique mission and therefore, may have a unique set of risks. Because of the unique set a risks, a specific location, Dyess Air Force Base (AFB), was chosen to validate the model.

Table 1.1: ACC Matrix Relating Manpower Level to Impact (Kennedy, 2007)

<table>
<tr><th colspan="2">Home-Station Staffing and Capability During Deployment</th></tr>
<tr><th>STAFFING %</th><th>IMPACTS</th></tr>
<tr><td>100%</td><td>Fire Department is fully staffed-fully capable</td></tr>
<tr><td>95%</td><td rowspan="2">FIRE DEPARTMENT IMPACT: Begin draw down of management positions. Shift personnel will begin to perform duties assigned to now vacant positions. EMERGENCY SCENE IMPACT: Reasonable expectation firefighting forces will be successful at performing aircraft fire/rescue, structural response, emergency medical support, hazmat operations, Homeland Defense (HLD) requirements and other related functions.</td></tr>
<tr><td>90%
FULLY
CAPABLE</td></tr>
<tr><td>85%
INCREASED
RISK</td><td>FIRE DEPARTMENT IMPACT: Further draw down of management. Essential management functions such as fire prevention/public education and training are curtailed. Management of fire protection flight functions begins to suffer without full time staff. Staffing variances are eliminated resulting in cross manning of vehicles. Reduce staffing assigned to each vehicle. Reduce staffing or completely close auxiliary flying fields and outlying fire stations. Firefighters work additional hours and leave begins to be affected. EMERGENCY SCENE IMPACT: Interior/exterior rescue or fire suppression capability is severely limited. Firefighting forces can still be expected to fight and control exterior fires. Firefighter safety is impacted, attempted rescue of trapped personnel severely endangers rescuers. Crew rehabilitation and firefighting re-supply capabilities are limited, sustained operations capability is restricted. HLD capability is limited.</td></tr>
<tr><td>75%
SEVERE RISK</td><td>IMPACT: Response capability is severely impacted; firefighter safety is at a higher level or risk. Long-term impacts are significant</td></tr>
<tr><td>70%
CRITICAL
RISK</td><td rowspan="3">FIRE DEPARTMENT IMPACT: Firefighters can expect to work extra hours and have all leave cancelled. To keep all available firefighters on vehicles, all mandatory appointments must be conducted off duty. Individual workloads increase greatly to cover responsibilities of vacant management positions. Morale is greatly affected by loss of leave, increased workload, and off duty appointments. EMERGENCY SCENE IMPACT: Single event limited response capability; flying activities may be limited or curtailed. Only limited exterior fire suppression can be performed. Responses will be significantly delayed. Rescue of trapped personnel should not be expected. HLD capability is inadequate</td></tr>
<tr><td>65%</td></tr>
<tr><td>60%</td></tr>
</table>

Research Objectives and Questions

Currently, when an FES flight has a manpower shortfall, the responsibility of determining the proper manpower level falls on the fire chief, the fire marshal, and the installation commander. The primary objective of this research was to create a methodology for a decision tool, using both historical data and qualitative expert opinion, which allows fire chiefs to quantitatively represent the change in risk in terms of manpower levels. The intention was not to create a model that recommends a solution, but rather provide a series of pareto optimal graphs for risk and cost/benefit, that provide insight and support to fire chiefs. Although the methodology was tested at Dyess AFB, the objective is to create a methodology that is applicable to the all USAF FES flights. In the process of validating the model, the accuracy of some USAF assumptions about manpower were examined.

Methodology

The primary research objective was to create a methodology for a risk-based decision tool for fire chiefs. In order to develop this methodology, certain steps were followed. The first step was to use historical and qualitative data to perform a risk assessment in accordance with Kaplan and Garrick (1981) and other available literature. The risk will then be aggregated for each manpower level and a series of pareto optimal graphs will be created. The second step was to determine the cost associated with the manpower levels and graph the cost/benefit relationship. The third step was to perform sensitivity analysis to determine the effect changes in uncertain values had on the analysis. The final step was to compare results with those of the manpower standards and assumptions.

This methodology was chosen for various reasons. The results must serve as a quick reference for fire chiefs. Deployments can occur with very little warning and there may not be the time to complete a complex risk analysis. The results must be presented in a manner that is not only operable to fire chiefs, but can be understood by fire marshals and installation commanders. FES manpower decisions are made by these three people and therefore, the results need to be operable to all of them. The final reason these steps were chosen is it simplifies the problem without sacrificing the validity. This allows the analysis to be accomplished using data and expertise readily available to installation Fire Chiefs.

Significance to the Air Force

This study will help Fire Chiefs better quantify risk. It will also help USAF decision makers (DM) choose deployment manpower strategies based on cost/benefit analysis. In deployment situations, FES flights are asked to keep the same level of coverage with less manpower. This methodology will allow leadership to reference a document that quantitatively compares risk and the cost/benefit relationship associated with manpower decision. Ultimately the results will help leadership manage costs while avoiding unnecessary risks.

Summary of Remaining Document

Emergency services are faced with tough manpower decisions on a daily basis. USAF FES flights face these same tough decisions, but also have to be concerned with manpower shortages created by deployments. Their decision attempts to balance cost with risk. This research developed a methodology to quantitatively analyze the risk and

the cost/benefit of the decision. The test case for this methodology was the FES flight at Dyess AFB.

This document has four remaining chapters. Chapter 2 is a literature review, which will discuss the main concepts and previous uses in the literature. Chapter 3 discusses the methodology and model used to determine the risk and cost associated with a shortage of manpower in a FES flights. Chapter 4 applies and tests the methodology discussed in Chapter 3 on the Dyess AFB test case. Chapter 5 discusses the results of the Dyess AFB case, shortfalls, and areas of future research.

II. Literature Review

Introduction

The United States Air Force (USAF) calls risk analysis and management, Operational Risk Management (ORM). The purpose of ORM is to increase the ability of the USAF to carry out the mission in both peacetime and wartime (AFPD 90-9, 2000). "The four guiding principles of ORM are: 1) accept no unnecessary risk, 2) make risk decisions at the appropriate level, 3) accept risk when benefits outweigh the costs, and 4) integrate ORM into operations and planning at all levels." (AFPD 90-9, 2000:1) The purpose of this chapter is to provide literature background on the areas pertinent to risk analysis and management research. It provides an overview of risk analysis, decision analysis, decision trees, influence diagrams, and manpower. In addition, it provides some insight into the USAF Fire and Emergency Service (FES) flights' responsibilities regarding risk analysis. In this document, the term FES flight was used to represent a USAF FES flight unless otherwise denoted. In order to study risk a definition of risk was developed first.

Background on Risk

Risk has been defined many ways in the literature and for many different situations. Frohwein et al. (1999) described risk as "a family of measures of the probability and severity of adverse effects." This definition lacks any mention of the causes of the adverse effects. Hirschler (1992) defined risk specifically for fire scenarios. Fire risk is "a measure of fire loss (life, health, animals, or property) that combines (a) the potential for harm in the various fire scenarios that can occur and (b) the probabilities of

occurrence of those scenarios, within a specified period, in a defined occupancy or situation." (Hirschler, 1992) This definition is valid if the risk of fire was the only concern, but FES flights' responsibilities include much more than just fighting and preventing fires. However, Hirschler did include an important detail other authors have not included in their definition. Hirschler stated risk should be analyzed over a "specific period" and a "defined occupancy." This research used a "specific period," one day, and a "defined occupancy," Dyess AFB. The USAF defines risk as "the probability and severity of loss or adverse impact from exposure to various hazards." (AFI 90-901, 2000) The USAF definition makes the assumption that a "hazard" will occur. The definition used for this study was a combination of Hirschler (1992) and AFI 90-901 (2000). Risk is defined as the likelihood of an occurrence of a Fire and Emergency Services scenario and the associated loss over a specific period and a defined occupancy.

To make the risk definition useful to a decision maker, risk must often be quantified. In this research, Quantitative Risk Assessment or Analysis (QRA) was used to quantify risk (Apostolakis, 2004). In QRA, risk can be determined from three basic questions 1) What can go wrong?, 2) How likely is it?, and 3) What are the consequences? These questions translate risk into a function of all the risk scenarios (S_i) (Kaplan and Garrick, 1981). Each of these risk scenarios is quantified with a likelihood (L_i), and consequence (X_i) (Kaplan and Garrick, 1981). The concept of risk as a function of the risk scenarios is the basic foundation, but many different approaches to QRA have been developed.

Risk Analysis and Management

The QRA methods differ in approach, but they are all intended to find a set of risk scenarios and the scenario's associated likelihood and consequence. One approach is to examine the consequences first. An example of the consequence-first approach is Apostolakis' (2004) five-step approach, which is based on determining what bad can happen and then finding the risk scenarios that create those consequences. Apostolakis' (2004) five evaluation steps are: 1) create a list of "undesirable end states," 2) determine "initiating events" (IE), 3) identify the sequence of events to create "accident scenarios," 4) determine the probability of the scenarios, 5) rank the scenarios in terms of frequency. Apostolakis also stated that peer review of the process is an important step. Another approach to QRA is to determine the risk scenarios first. The USAF proposed accomplishing this through a six-step process. The six steps are: 1) identify risk scenarios, 2) aggregate consequences with likelihood to determine risk, 3) analyze to see the effects of risk avoidance, mitigation, or acceptance, 4) make appropriate decisions based on analysis in step 3, 5) implement appropriate decision, and 6) manage the risk throughout the life of the risk (AFPAM 90-902, 2000).

The consequence-first and the risk scenario-first approaches are useful in generating the list of risk scenarios. However, both of these models fall short of the desired result of this research. The approach proposed by Apostolakis (2004) is focused on simply ranking risk. The concept of this research was the aggregation of risk and mitigation of risk by using manpower, not simply a rank order. The AFPAM 90-902 (2000) approach is based on determining various mitigation options. For this research only one mitigation option, manpower, was considered.

The five-step approach proposed by Haimes (2004) is a risk scenario-first approach. It was chosen because the approach includes risk modeling, aggregation, and trade of risk. The purpose of this research was to analyze risk, therefore, only the first three steps were addressed. Steps four and five are the responsibility of the decision maker (DM). Haimes' (2004) five steps are: 1) identify risk scenarios, 2) quantify and model the likelihood and consequences, 3) evaluate the risks by aggregation or trade offs, 4) make appropriate decisions about the risk, and 5) execute decisions and manage feedback.

Determining Risk Scenarios

The first step in Haimes (2004) QRA approach is determining a set of risk scenarios. Developing a list of scenarios can be challenging, especially in areas like FES flights where there are a wide range of responsibilities. "Finding scenarios is part science and a large part art" (Kaplan, 1997). Some of the difficulty is created by the requirement that risk scenarios "be (1) complete, (2) finite, and (3) disjoint." (Kaplan et al., 2001) In general, there are three basic ways to determine risk scenarios. The first two, consequence-first (Apostolakis, 2004) and scenario-first (AFPAM 90-902, 2000; Haimes, 2004), were discussed earlier. The third method is to start in the middle. Kaplan (1997) stated the process can be started in the middle, in between the initiating event and the consequence, and worked in both directions. There are various techniques for accomplishing scenario generation.

The first examples of risk scenario generation techniques are processes using hierarchical approaches. Examples of techniques that use hierarchical modeling are the analytic hierarchy approach, or AHP (Vaidya and Kumar, 2006), risk ranking and

filtering or, RRF (Haimes, 2004), and hierarchical holographic modeling, or HHM (Haimes et al., 2002). One of the unique characteristics of HHM is the list of risk scenarios is not intended to be disjoint (Kaplan et al. 2001). Other examples of risk scenario generation approaches are approaches that simply make a list by asking experts a simple question. Examples of this are asking what can go wrong, (Kaplan and Garrick, 1981) and TRIZ, which asks, “If I wanted to make something go wrong, how would I do it?” (Kaplan, 1997). There are other approaches to scenario generation, see Kaplan et al. (2001) for additional methods.

In many situations the list of risk scenarios can be a large, virtually infinite list. Kaplan and Garrick (1981) addressed this by defining S_i, not as a list of individual scenarios, but rather a list of “categories of scenarios.” This research used Kaplan and Garrick’s (1981) categorical approach to scenario generation. The FES Reshaping Conference (2006) developed a list of FES responsibilities. The categories of scenarios were developed from this list. An additional “Other” category was added. The “Other” category consisted of all the risk scenarios not already included in the categories (Kaplan and Garrick, 1981). This approach ensured a complete, finite, and manageable list of scenarios or categories. The actual category generation is discussed in further detail in Chapter 3. Once the scenarios were generated, the likelihood and consequence of each scenario was determined.

Determining Likelihood

Developing the likelihood of a risk scenario has been accomplished using numerous approaches. Three such approaches are subjective, objective, and objective mathematical approaches. All three of the methods have positive and negative aspects and many times multiple approaches are used in a risk analysis. The approaches have been used in the literature in several areas including risk analysis.

Subjective likelihood is determined by eliciting expert opinion, logical inference, or observation. Subjective likelihood allows analysis of areas where data is not available, like Keeny and Winterfeldt's (1994) analysis of a nuclear repository 100 years in the future. In addition, subjective likelihood can be used where historical data is determined to be a poor representation of future occurrences (Korte, 2003). One example of subjective approach is the use of pair-wise comparisons of risk scenarios. AHP uses pair-wise comparisons to determine likelihood by soliciting experts to determine the likelihood of a risk scenario in comparison with the likelihood of the remaining risk scenarios (Dey and Mukherjee, 2005). Expert opinion or subject matter experts are also used to develop likelihood. Korte (2003) used expert opinion to determine the likelihood of a safe landing in a helicopter experiencing vibrations. However, expert opinion may vary from expert to expert. Winterfeldt and O'Sullivan (2006) used a range to represent the likelihood for risk scenarios when analyzing the need to protect commercial airlines from surface-to-air missile attack.

Objective probabilities are those that are measured using historical data, mathematical process, or another accepted scientific process. A historical approach to likelihood uses occurrences of a scenario in the past to predict occurrences in the future.

Historical approaches are used commonly when the environment or process leading to the scenario remains relatively unchanged. Peck and Kavet (2005) used historical data to predict likelihood of a child developing leukemia.

Mathematical distributions are another objective method used to determine likelihood. These distributions can be continuous or discrete distributions. Cox et al. (2005) used the binomial distribution to estimate the likelihood of detecting disease in cattle. Other examples are the exponential, normal, gamma distributions. See Trueman (1974) and Berger and Zeng (2006) for more information on the application of continuous and discrete distribution.

For this research another mathematical distribution, the Poisson distribution, was used to estimate likelihood. Clemen and Reilly (2001) stated the Poisson distribution is good "for representing occurrences of a particular event over time and space." In other words the Poisson distribution is used to represent an event or "scenario" over time or a "specified time" and a space or "defined occupancy." The Poisson distribution was chosen because of its relevance to the risk definition used. However, Clemen and Reilly (2001) stated a "scenario" has to meet four criteria for the Poisson distribution to be valid. The four criteria are: 1) the scenario "can happen at any number of places within the" defined occupancy; 2) the likelihood of an event is small at any given point; 3) scenarios are independent; and 4) the average number of scenarios does not change over the defined occupancy or the specified time. Kolesar and Walker (1973) used the Poisson distribution to estimate fire alarm occurrence over specified regions in New York City. Risk scenarios and likelihood have been defined. The final variable is consequence.

Determining Consequences

Kaplan and Garrick (1981) define a consequence for risk as “some kind of loss or damage received.” In terms of risk, a consequence is negative outcome of a risk scenario. The USAF considers three consequences in risk analysis: (a) the threat to the mission capability, (b) potential casualties and loss of life, and (c) loss of property (AFPAM 90-902). Similar to the USAF, Winterfeldt and O’Sullivan (2006) use monetary loss of property, monetary loss to the industry, loss of life, and cost of maintenance as consequences. In some cases, risk is a function of one consequence. Korte (2003) assumes only one consequence, loss of life, is a factor in a pilot’s decision to ditch a helicopter or attempt to fly it to a safe landing zone. The consequences used in this study were total cost to include property loss and response cost and loss of lives.

Modeling Techniques

A variety of different techniques have been developed for performing QRA. Many of these techniques use a hierarchical approach to QRA. An example of a hierarchical approach is risk ranking and filtering (RRF). RRF is a technique developed by the National Aeronautics and Space Administration consisting of a hierarchical approach to scenario generation, quantification of the scenarios, a filtering process, and then ranking of the scenarios. RRF led to the development of risk filtering, ranking, and management (RFRM) (Haimes, 2004). RFRM uses hierarchical holographic modeling (HHM) to generate risk scenarios, but unlike RRF, the scenarios undergo a filtering process before quantification. Additionally, management and feedback steps have been included in RFRM (Haimes et al., 2002). RFRM and HHM have been used in many different risk assessments including prioritizing structures for protection against terrorist

attacks by Leung et al. (2004). For other examples see Haimes et al. (2002) and Haimes (2004). One of the methods HHM uses to filter scenarios is pair-wise comparison.

Another method that relies heavily on pair-wise comparisons is the analytic hierarchy process (AHP). AHP is a method of developing a hierarchy to represent a decision and analyzing the hierarchy through a series of pair-wise comparisons. After the pair-wise comparisons have been analyzed, the problem can then be analyzed as demonstrated by the application to risks in project management shown in Dey and Mukherjee (2005). AHP differs from many other hierarchical approaches because often, the desired result is not just a ranked list of scenarios, but rather an aggregate value for risk.

Computer simulation models are generally intended to produce an aggregate value for risk. Olofsson and Blennow (2005) used computer simulation to identify factors that increase the probability of damage to spruce trees. Another example of computer a simulation technique is Monte Carlo simulation. Monte Carlo simulation is used to calculate an outcome distribution for uncertain events with continuous distributions. It produces the outcome by picking a random number within the range of probability of an uncertain event and assigns that number to that uncertain event. This simulation is repeated and eventually results in an outcome distribution (Dillon and Haimes, 1996). Pires et al. (2005) used a computer based risk algorithm to predict the room of origin for a fire.

In addition to quantitative risk analysis (QRA) there is also qualitative risk analysis. Mulvhill (1988) performed risk analysis using two qualitative risk approaches, hazard and operability (HAZOP) analysis and fault trees, and two quantitative analysis

methods, event sequence diagrams and event trees. The analysis was performed and the pros and cons of the techniques were compared. Laughlin (2005) proposed a new qualitative risk analysis technique called comparative risk analysis (CRA) for creating policy for fire plans. Many quantitative and qualitative techniques were examined, but it was decided the best modeling technique for this research was decision analysis (DA).

Decision Analysis

Decision analysis is a process to break down and analyze a complex decision. This analysis is intended to provide insight to the decision maker (DM) that will help the DM to consistently make a good decision. DA does not, however, attempt to make the decision for the DM. It is simply a method to provide structure to the process (Clemen and Reilly, 2001). Kirkwood (1997) proposed that part of DA is to provide more justification for a decision. Therefore, a quantitative approach should be used in decision-making. In order to quantify a decision, Kirkwood (1997) defined three parts: the alternatives, the consequences, and uncertainty. These parts correlate directly to the three variables of risk analysis (risk scenarios, consequences, and likelihood), which made DA a very effective technique in quantifying risk. Clemen and Reilly (2001) defined a specific process in DA shown on Figure 2.1. Other literature has slightly different verbiage to describe the decision making process, but the results are the same (Kirkwood, 1997; Raiffa, 1968; Trueman 1974).

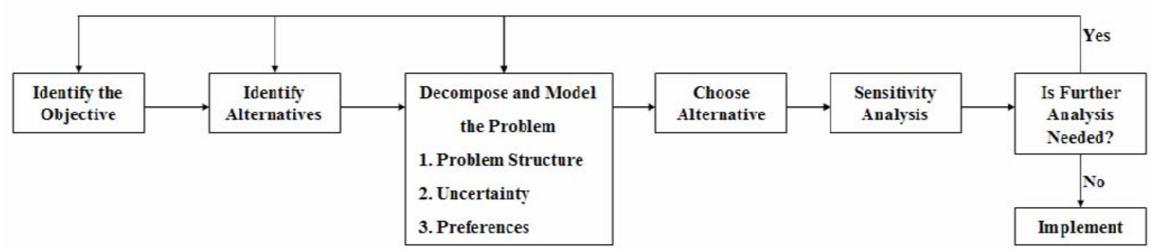

Figure 2.1: Clemen and Reilly (2001) Decision Analysis Process

Uncertainty plays an important role in a decision. If everything is known about a decision, then the decision making process is trivial. However, it is rare to know everything about a decision (Trueman, 1974). There are two types of uncertainty in decisions, objective and subjective. When analyzing decisions, it may not always be possible or practical to obtain objective probabilities. Therefore, subjective probabilities must be used (Haimes, 2004). The analysis in this research used both objective and subjective probabilities as part of the model.

The literature includes some skeptics regarding the applicability of traditional DA in dynamic situations, such as the response to specific emergency situations. Klein and Calderwood (1991) argued that in a dynamic situation the DM does not have adequate time to use analytical methods and must rely on expertise or personal judgment. This "intuitive" approach to decision analysis, called recognition-primed decision (RPD), concluded that it is more important for a DM to understand the current condition and make a situational assessment, rather than develop and analyze all of the possible alternatives. Korte (2003) argues that expertise is not enough. A DM must be given tools and guidelines to make decisions that minimize the consequences. The risk should be analyzed prior to a poor decision (Korte, 2003). This risk analysis for this study is

being performed before the actual occurrence of an emergency. This is similar to the concepts proposed by Korte (2003). Once an emergency has occurred it is too late to make manpower decisions.

Influence Diagrams

An influence diagram is a simplified, graphical model of a decision problem. One advantage is the influence diagram "is intuitive enough to communicate with the decision makers and experts and, at the same time, precise enough for normative analysis" (Shachter, 1986). Diehl and Haimes (2004) stated "The versatility of an influence diagram helps to foster communication between the domain experts, decision makers, and decision analysts when solving complex decision problems." An influence diagram consists of nodes and arcs. The nodes represent uncertainties, decisions and consequences. The arcs represent either dependence or sequential order (Shachter, 1986; Shachter, 1988).

Samples of a single objective decision tree can be found in Shachter (1986) and Shachter (1988) and Lui et al. (2004). A sample of a multi-objective tree is found in Diehl and Haimes (2004). Influence diagrams can be used analyze and to calculate the expected outcome of a problem (Diehl and Haimes, 2004; Shachter, 1986; Shachter, 1988). However, influence diagrams are simplified representations of a problem or decision and the math may not be as straightforward as in a decision tree. Therefore, all analysis was done using a decision tree. An influence diagram was an effective starting point for the creation of a decision tree.

Decision Tree

Raiffa (1968) described a decision tree is a “road map” of a decision. Decision trees are used to aggregate decision alternative scores as a function of uncertain events and event outcomes (Raiffa, 1968). An uncertain event is the likelihood of a risk scenario and the uncertain outcomes are the likelihood of a consequence, making a decision a logical choice for aggregation of risk. In order to properly model a decision in a decision tree, the uncertain events must follow two rules. The uncertain event must be collectively exhaustive and mutually exclusive meaning the uncertain event must have exactly one possible outcome (Clemen and Reilly, 2001).

Decision trees follow a sequential order, so the placement of decision and chance nodes may be important. Decision nodes should be placed before the chance events that will still be uncertain at the time that decision will be made. Chance events that are conditionally dependent should be placed in the proper chronological order. If chance nodes are independent, the order in which the events are modeled, as long as it is after the appropriate decision node, is arbitrary (Diehl and Haimes, 2004).

There are two basic types of decision trees. The type chosen depends on the goal. The first type is a decision tree designed to provide insight about a decision. This decision-based decision tree is designed to model all of the pertinent information around a decision or series of decisions. The ultimate goal of decision-based decision trees is to consistently make good decisions (Kirkwood, 1997). The second type of decision tree is based on inductive reasoning. An inductive decision tree is focused on classification. Inductive decision trees attempt to classify an unknown object by matching the unknown object’s patterns to the patterns of a known class of objects (Quinlan, 1990). Two

examples of the application of inductive decision trees are diagnoses of hypothyroid conditions (Quinlan, 1999) and evaluation of the credit-risk of an applicant (Mues et al., 2004). For the purposes of this research, decision-based decision trees are referred to as decision trees. Inductive decision trees were not used for this research.

One of the difficulties with decision trees is that they can easily become too large for a DM to comprehend. The number of nodes and the continuous variables can make the decision tree hard to manage and understand (McCreary, 1973). Decision trees must be accurate enough to be useful, but a decision tree must be simple enough to understand (Quinlan, 1999). There are various ways to simplify a model. McCreary (1973) briefly covered two general approaches. This first, the common sense approach, is accomplished by eliminating branches that are not feasible or eliminating chance nodes that are determined not to be a part of the decision process or provide no added value. The second approach is an analytical process. The analytical process trims a tree by simplifying forks in the tree, which can result in an exponentially smaller tree. An example of trimming the forks would be to truncate an uncertain event while maintaining an adequate level of accuracy.

Sensitivity analysis can aid in trimming unnecessary branches. Sensitivity analysis will be discussed in detail later in this chapter. Techniques used to filter and rank risk scenarios discussed earlier (Haimes, 2004; Haimes et al., 2002) can be used to simplify decisions. For problems in which a decision tree cannot be simplified to an understandable or functional level, a graphical decision tree can be eliminated. A decision tree can be represented as a series of mathematical formulas and the data can be

organized in a table (Berger and Zeng, 2006). Once the tree has been formed there are various methods for analyzing the tree.

Decision Tree Analysis

Expected value (EV) is a common methodology for analyzing decision trees (Frohwein et al., 1999). Analysis of a decision tree by means of EV is called "folding back" or "rolling back" the tree. A decision tree's EV is calculated by starting at the termination node and continuing to "roll the tree back" until the first level decision is reached. When a chance node is encountered, the probability and consequence for each individual branch is multiplied. Each individual branch on a chance node is then added together. When a decision node is encountered, the consequence on each individual branch is analyzed and the appropriate branch is chosen (Clemen and Reilly, 2001).

EV may be effective for many decision trees, but there are cases where EV fails to be a valid representation of the goal. In problems where EV is not a good solution or probabilities are not available, there are a number of established rules for decision tree analysis. Some examples of other techniques used to solve decision trees are the maximax rule, the maximin rule, the equal likelihood rule, and the minimax regret rule. For more detailed information on these rules see Trueman (1974). An additional technique is the Hurwicz rule. For more information about the Hurwicz rule see Haimes (2004) and Frohwein et al. (1999). However, expected value (EV) was determined to be the most representative technique for this research and therefore was used to solve the decision tree.

Single Dimension Value Function (SDVF)

A single dimension value function (SDVF) is used in multi-objective decision analysis to convert the consequence values into a common unit. Many of the consequence relationships (SDVF for this study) in the literature are linear. Korte (2003) uses a linear relationship for loss of life. Keeny and Winterfeldt (1994), Cox et al. (2005), and Winterfeldt and O'Sullivan (2006) used linear relationships for cost and loss of life consequences. Converting the consequences into common units allows trade-offs between the consequences to be established (Kirkwood, 1997).

Additive Value or Trade-off Function

Kirkwood stated trade-offs between the consequences can be used to combine the consequences into a single consequence. The method used in this research to create a single consequence is the additive value function. The trade-off values are the relative importance of the consequences in terms of making the decision, and they are used to calculate the weights of the additive value function. One of the assumptions with the additive value function is mutual preferential independence. Mutual preferential independence means there is no preferential dependence between any of the variables used in the function. Variable X is preferentially independent of variable Y, if changes in Y do not change the value of X (Kirkwood, 1997). Once the consequences have been combined into a common unit, the tree can be "rolled back" resulting in a list of values for each decision. However, because there is often uncertainty involved in a decision tree, other methods have been developed to further analyze decision tree results.

Value of Information (VOI)

Value of information is "the benefit of collecting additional information to reduce or eliminate uncertainty in specific decision making context" (Yakota and Thompson, 2004). VOI analysis looks at the payoff of having better information compared to the cost of obtaining the information. "By considering the expected value [of information] we can decide whether an expert is worth consulting, whether a test is worth performing, or which of several information sources would be the best to consult" (Clemen and Reilly, 2001). Another aspect of VOI is sensitivity analysis. If a variable of a decision does not impact that decision, then it would be a waste of time and resources to collect more information on that variable (Clemen and Reilly, 2001).

Sensitivity Analysis

Eschenbach (1992) defined sensitivity analysis "as examining the impact of reasonable changes in base-case assumptions." Trueman (1974) stated sensitivity analysis is an "approach which allows us to explore the effect on the optimal decision(s) of possible changes in any of the problem variables." There are a number of reasons why sensitivity analysis is used. Kirkwood (1997) explains sensitivity analysis is used "to determine the impact on the ranking of alternatives of changes in various model assumptions." In addition "sensitivity analysis may be used (1) to make better decisions, (2) to decide which data estimates should be refined before making a decision, or (3) to focus managerial attention of the most critical elements during implementation" (Eschenbach, 1992).

There are multiple means of performing sensitivity analysis on a decision. One-way sensitivity analysis is used to determine the effect the range of a variable has on the

EV. One-way analysis graphs an uncertain variable on the x-axis and plots it against the EV of the alternatives. If alternative lines cross, the EV for the alternatives is equal at that point. This signifies a change in the preferred decision (von Winterfeldt and O'Sullivan, 2006). A tornado diagram stacks all of the variables, so their effect on the EV can be compared (Clemen and Reilly, 2001). "A tornado diagram quickly highlights those variables to which the outcome is most sensitive" (Eschenbach, 1992). A spider plot is a graph of the change in each variable against the expected value. Because of the complexity of a spider plot, the number of variables that can be plotted together is limited; however, spider plots contain more information than other types of sensitivity analysis (Eschenbach, 1992). Two-way sensitivity analysis provides insight into the interaction of two variables with EV. Two-way analysis is a graph with one variable on the x-axis, one variable on the y-axis, and a curve to show where the preferred solution changes.

Utility

Utility is a DM's attitude toward risk. Utility is captured by replacing EV with expected utility (EU) (Kirkwood, 1997). When determining utility, consideration should be given to "the decision maker's attitude in two aspects: the attitude toward profit which associates with the payoff value and the attitude toward risk which associates with the risk or probability of the alternative" (Liu and Da, 2005). There are three types of decision makers with regards to risk: (a) risk averse, (b) risk neutral, and (c) risk seeking (Kirkwood, 1997). There are multiple theories and methods to account for risk in a decision maker (Clemen and Reilly, 2001; Haimes, 2004; Kirkwood, 1997; Lui and Da,

2005). This purpose of this study was to present the actual risk levels to the DM so a more informed decision can be made. Therefore, utility was not used in this research.

Decision Tree Models in Literature

Diehl and Haimes (2004) stated that decision trees have become "perhaps the most well known representation of decision problems." Because a decision tree analyzes a decision as a function of the chance of an uncertain event and the resulting consequences, it can almost always be seen as form of risk analysis. Often times, decision trees analyze the effect of different mitigation techniques on the risk level. In addition, decision trees are not specific to a certain field. A review of the literature that discusses decision trees show they have been used widely and in many diverse fields.

Decision trees have been used in project management. Gustafsson and Salo (2005) created and designed a decision tree to provide the DM with insight into which risky projects to start and/or continue. The tree has multiple decision points along the way which allow for cost benefit analysis throughout the length of a project. This allows the DM opportunities to decide whether to start a new project, continue an existing project, or cancel existing projects to maximize expected monetary value (EMV). Gustafsson and Salo included uncertainty about money available and decisions were based on the payback for resource allocation (Gustafsson and Salo, 2005)

As discussed earlier, Cox et al. addressed the problem of tracking imported Canadian cattle in the United States (U.S.). The "tracking" or "not tracking" of cattle is the decision and is also a risk mitigation technique. The decision tree is modeled based on the risk of disease from imported Canadian cattle. The consequences were cost of tracking and testing and lost revenue due to adverse market reaction. Cox et al., used a

trade-off function to combine the consequences. For tracking and testing cost, historical data and logical reasoning were used to determine the probabilities. For infection rate, historical data was used in combination with the binomial distribution. Cox et al. based the decision on EMV (Cox et al., 2005).

Decision trees can be used for situations that involve politics or emotion and analyze them strictly as analytical problems. For example, Keeny and von Winterfeldt (1993) used decision trees to analyze the optimal management of spent nuclear waste. Two trees were developed in this model. The first tree examined the present decision and the second tree looked at the decision to be made in 100 years (the proposed time the repository will accept waste). The alternatives for the present and future trees were storage location. The uncertainty in the "present" tree was the possible licensing issues and were primarily technology based uncertainties dealing with advances in the handling of nuclear waste, constructing repositories, and medical treatments for cancer for the "future" tree (Keeny and von Winterfeldt, 1993).

Keeny and von Winterfeldt (1993) examined nine consequences, based on the Nuclear Waste Policy Act, in the study. The consequences included loss of life, social impact, direct costs, indirect costs, and environmental issues. Cancer cases and loss of life were determined by previous studies (DOE, EPA, etc.) and logical judgments and consider all areas including construction, transportation, radiation, etc. A linear value tradeoff was determined to aggregate consequences into a common unit. Loss of life "pre-closure" and "post-closure" was estimated to have a $4 million to 1 and $1 to 1 million value tradeoff, respectfully. Likelihood was almost all subjective, although some historical data was used. Both value tradeoffs and "arbitrary" likelihood determinations

were addressed in the sensitivity analysis. Keeny and von Winterfeldt based the decision on EMV and the resulting sensitivity analysis (Keeny and von Winterfeldt, 1993).

As discussed earlier, Berger and Zeng (2006) used decision tree analysis without actually creating the graphical tree. The decision was the optimal number of sources to use as suppliers. Using the mathematical representation also helped with sensitivity analysis because changes to the approximations of the uncertainties could easily be made. The large amount of uncertainty made this problem too complicated to represent on a decision tree. However, the decision only has one chance node, one probability, and one consequence.   The lack of diversity in the tree brings accuracy into question.

Korte (2003) used risk analysis and decision trees to determine the preferred solution for an emergency situation in an offshore helicopter. Nine rules of "contingent risk and decision analysis" are described. A graphical representation of Korte's (2003) rules can be seen on Figure 2.2.

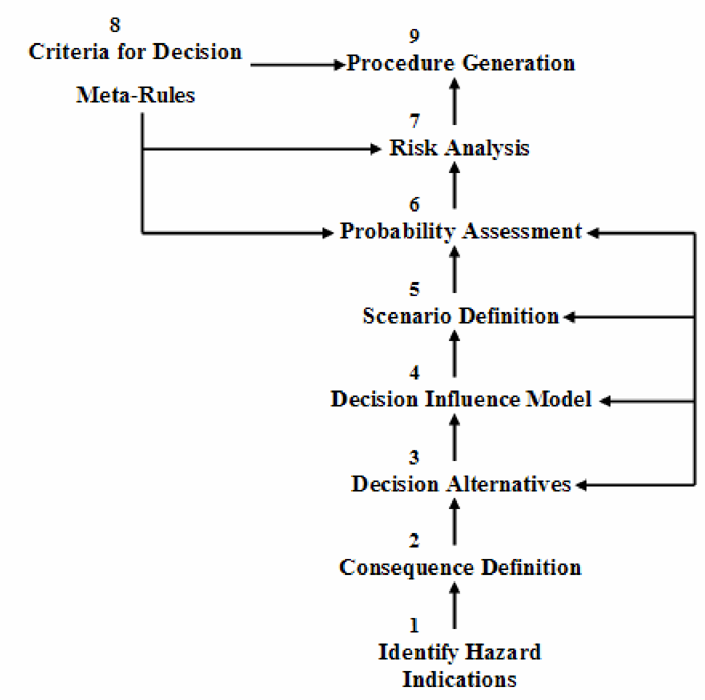

Figure 2.2: Nine Rules of Contingent Risk and Decision Analysis (Korte, 2003)

The decision was whether to attempt to fly the helicopter back to a landing site or attempt an emergency landing, and the consequence was loss of life. Loss of life and probabilities were determined by three factors. The first is the weather, defined as calm, moderate, severe, or extreme. The second is the condition of the sea, defined as the temperature of the sea, determined by the season (winter, intermediate seasons, and summer). The final factor was the time it takes rescue crews to respond. The factors were known at the time of emergency. Loss of life and likelihood were determined conditionally to the three factors. Korte (2003) recognize other consequences like material loss, but these consequences were not included because the only time material loss would be considered is when there was not a clear decision based on fatality risk (Korte, 2003).

Another example of using decision trees to analyze risk mitigation techniques is from vonWinterfeldt and O'Sullivan (2006). A decision tree was used to determine if equipping commercial airplanes with missile countermeasures would be cost effective. There was a large amount of uncertainty in both the likelihood and consequence of the decision. There were multiple reasons for the uncertainty, i.e. the diversity of the airline industry, unpredictability of terrorist strikes, different types of missiles, and classified information. Instead of determining the actual likelihood and consequences, von Winterfeldt and O'Sullivan (2006) used ranges for these values. A base case was chosen, the tree was "rolled back," and sensitivity analysis was preformed (von Winterfeldt and O'Sullivan, 2006)

According to von Winterfeldt and O'Sullivan (2006) the preferred decision was determined by analyzing five consequences. The consequences were: (a) loss of life (LL), (b) cost of plane (CP), (c) economic loss (EL), (d) number of false alarms (FA), and (e) cost of countermeasures (CC). With the exception of LL and FA, all other figures were in dollars. In order to create a common unit, the monetary value of a life (VOL) was estimated to be a range from $0 to $10 million per life with a base case of $5 million and the monetary value of a false alarm (VOF) was estimated to be a range from $0 to $100 million per incident, with a base case of $10 million. Both of these trade-off functions were linear relationships. Multiple methods of sensitivity analysis were performed in von Winterfeldt and O'Sullivan (2006). The first analysis was the manual manipulation of the likelihood and consequences values. This was accomplished by using a program that used "sliders" to adjust the values and produced real-time graphical results. Tornado analysis was then performed and allowed for visual representation of

the effect of each variable on the decision. One-way sensitivity and two-way sensitivity analysis were also performed (von Winterfeldt and O'Sullivan, 2006).

Manpower in Literature

Many different types of manpower problems and decisions have been addressed in the literature. Various scheduling issues have been solved. Legato and Monaco (2004) used a linear program (LP) to solve a scheduling issue of varying manpower in a marine container terminal. A long-term schedule, which was fixed, and a short-term schedule, which could vary, were created to optimize costs and provide adequate manpower to cover fluctuations in demand. A similar scheduling problem was addressed by Wild and Schneeweiß (1993). Wild and Schneeweiß (1993) used a hierarchical approach to decompose and solve the scheduling problem. Additionally, computer technology has aided manpower scheduling. Verbeek (1991) created software to simplify and aid in the scheduling of airline pilots. Elhakeem and Hegazy (2005) used graphs to simplify scheduling options for the DM. Computer models have allowed for much of the complex math to be hidden from the DMs, for rapid recalculation to adjust for unforeseen problems, and for simulations to be run prior to actual scheduling. Firefighter scheduling, to provide at least minimum manpower coverage, was addressed with linear programming by Fry et al. (2006). However, Fry et al (2006) did not attempt to determine the minimum manpower level, it was already determined prior to the research. Scheduling research attempts to determine the personnel that are needed to handle a load. However, some manpower research has focused on the proper location and relocation of manpower to mitigate risk.

Mathematical programming has been used to determine the proper deployment and relocation of emergency services. Sathe and Miller-Hooks (2005) used mathematical programming to optimize the location and relocation of military security forces. The goals were to minimize costs and appropriately guard all critical facilities. Kolesar and Walker (1973) developed a model for the location of fire houses and relocation of fire companies to provide at least minimum coverage in all areas. Kolesar and Walker (1973) defined minimum coverage as "at least one of the closest three engines and at least one of the closest two ladders must be available for every alarm box in the city." Church et al. (2001) discussed the role of computer aided dispatch (CAD) programs and other technologies in improving upon mathematical modeling for location and relocation of emergency services.

Firefighter manpower has also been examined as a function of risk. Halpern et al. (1982) used risk as a function of time to complete an emergency activity and network analysis to determine manpower. Networks of events to complete various scenarios were mapped, and then the time to complete each network was developed. Halpern et al (1982) suggested that the time-based networks can be used to determine proper manpower levels. In addition to Halpern et al. (1982), Lawrence (2001) also evaluated manpower by quantifying risk as a function of time. Four experiments were conducted with different size fire crews and the time to complete each scenario was recorded. Fire department manpower recommendations were made based on the size of fire crew and time relationship.

Summary

The literature review provided the background on risk, methods to quantify risk, and decision analysis. It also provided examples of risk, manpower, influence diagrams, and decision trees that were used as the basis for this research. The research showed there is a lack of literature that attempts to quantify risk and determine manpower based on this quantification. In most cases the manpower levels are determined or subjectively assumed prior to analysis. This study quantified the risk for an FES flight and analyzes the effect different manpower levels have on that risk. The remaining chapters provide the methodology (Chapter 3), the data collection and results (Chapter 4), and the conclusion (Chapter 5), for this research.

III. Methodology

Introduction

This chapter defines the methodology used to determine and aggregate risk for associated manpower levels (ML) within the United States Air Force (USAF) Fire and Emergency Services (FES) flights. The goal of the research is to create a decision tool that will provide insight to the risk FES flights' decision makers (DM) assume when determining manpower levels. Risk is classically quantified by identifying the risk scenarios and the associated likelihood and consequences of each scenario. Therefore, in this research, the aggregate risk is a function of the risk scenarios an FES flight may encounter, each scenario's likelihood, and the associated consequence. A risk scenario is a combination of a potential need for an FES response and the manpower available to respond. The formula consists of the following three components (Haimes, 2004; Kaplan and Garrick, 1981):

- S_i represents risk scenario i (combination of FES alarms and manpower level)
- L_i represents the likelihood of ith scenario (the likelihood of each scenario)
- X_i represents the consequence of the ith scenario (the average cost in dollars and loss of lives)

Kaplan and Garrick (1981) combined the variables to form the following classic risk equation, Equation (3.1). The c, added later (Haimes, 2004), symbolizes that the list should be a complete list of scenarios.

$$R = \{< S_i, L_i, X_i >\}_c \tag{3.1}$$

General Approach

The general approach of this research is a slight variation of the methodology proposed by Clemen and Reilly (2001) and Korte (2003) and is shown in Figure 2.1 and Figure 2.2, respectively. A combination of the two methods was used to apply Clemen and Reilly (2001) decision analysis (DA) techniques to a risk analysis methodology similar to the one shown in Korte (2003). The steps are shown on Figure 3.1.

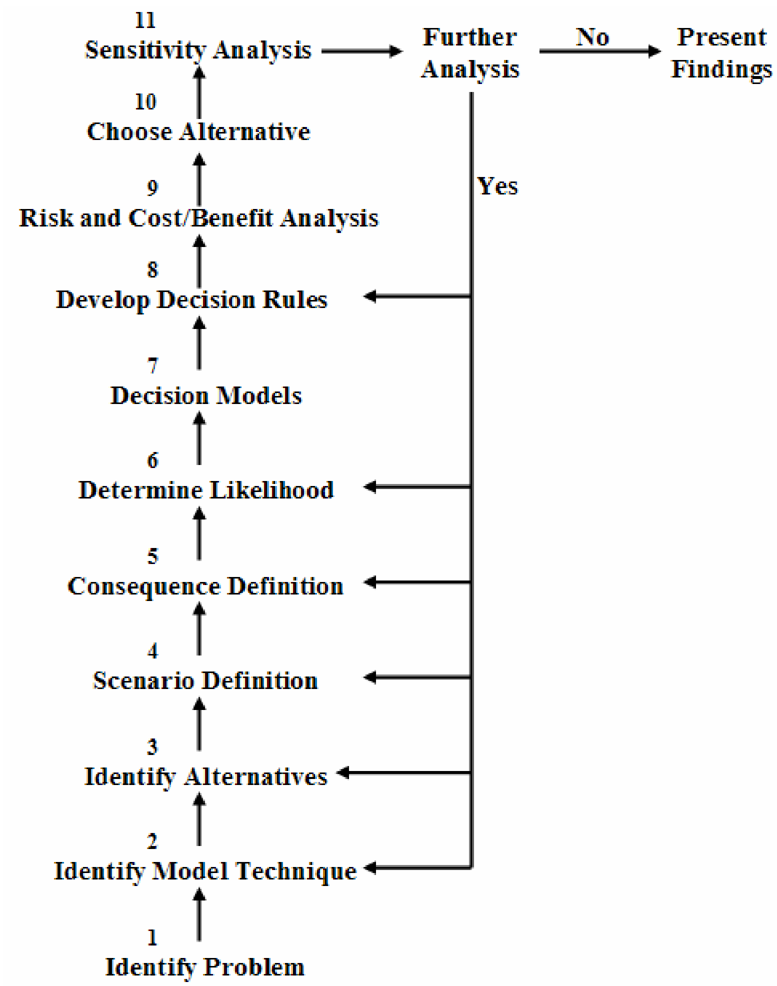

Figure 3.1: Model of the Approach Methodology

Figure 3.1 shows the individual steps of the methodology used in this study. Chapter three details the methodology of steps1 through 11. Chapter 4 addresses the actual analysis and presents the findings.

Problem

The problem is to determine the risk associated with an FES flight's manpower level and then to determine cost/benefit relationship. The mitigation technique utilized is varying levels of manpower. The USAF is a large and diverse organization and FES flights may differ from one other. Because of the possible differences in risk and manpower decisions, a single installation with its associated DM is used to validate this approach to risk quantification. Dyess Air Force Base (AFB) was chosen as a representative installation to show the applicability of the methodology and the model. The DM for the analysis is the Deputy Fire Chief at Dyess AFB, who, due to temporary duty of the Fire Chief, was acting Fire Chief at the time of data collection. The DM has more than 25 years of USAF firefighting experience at Dyess AFB and more than 27 total years of firefighting experience. This research is studying manpower shortages due to a standard 134-day deployment. However, the risk analysis was run over the time frame of one 24-hour shift or one day. A one-day time frame was chosen because it is assumed that manpower scheduling can be done on a shift-by-shift basis.

Model Technique

A decision tree was chosen as the analytical tool used to quantify Dyess AFB FES manpower risk for a deployment. A decision tree quantifies a decision as a function of scenarios, scenario probabilities, and outcomes and therefore, provides an excellent structure to calculate Equation (3.1). A primary benefit of decision trees is the ability to

analyze the possible outcomes of a chance event and the impact of that chance event's consequence. A decision tree also allows the decision maker to see the data across all of the alternatives in order to help determine the preferred decision (Clemen and Reilly, 2001). In a decision tree, the likelihood (L_i) correlates directly to the probability assigned to a chance node, the risk scenarios (S_i) are the events for a chance node, and the risk scenario consequences (X_i) correlate with the consequences or outcomes on the decision tree. Precision Tree (2004) software is used to create and analyze the decision tree. In this software a decision is represented by a square node, likelihood by a circle node, and consequence by a triangle node. A consequence can be entered at any one of the nodes, but for the purposes of this research, consequences were only entered at the consequence nodes. An example of a decision tree is shown in Figure 3.2.

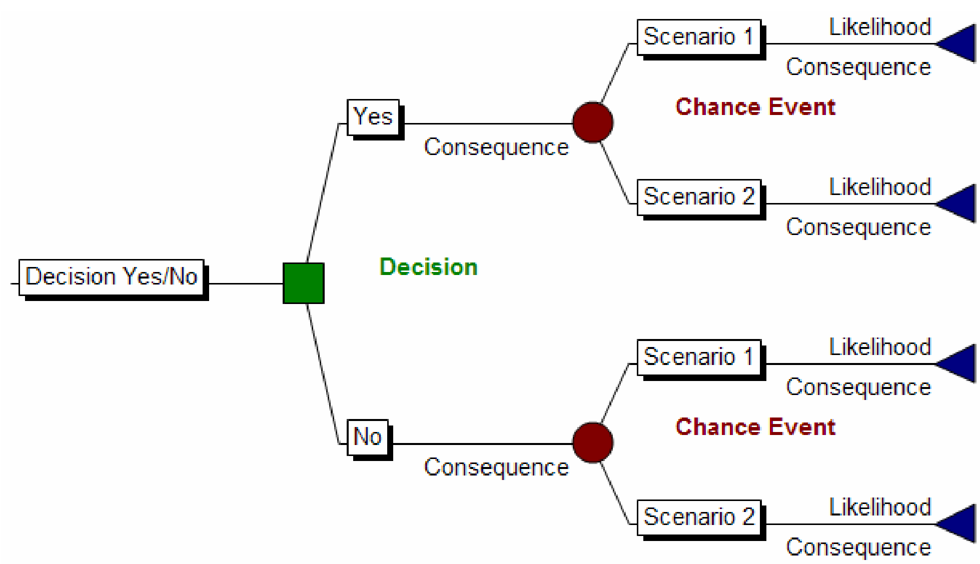

Figure 3.2: Decision Tree Example

The decision tree will be “rolled back” to calculate the expected risk value for each decision. Once the model is populated, the next step is to calculate the chance nodes, starting on the right of the decision tree. The formula for the calculation of a chance node is shown in Equation (3.2).

$$CN_n = \sum_{S_{n,1}}^{S_{n,i}} X_{S_{n,i}} * L_{S_{n,i}} \tag{3.2}$$

where:

n represents an integer 1, 2, 3, …, total number of chance nodes

CN_n represents chance node n

$S_{n,i}$ represents and scenario i of node n

$X_{Sn,i}$ represents the consequence for scenario i of node n

$L_{Sn,i}$ represents the consequence for scenario i of node n

Once a chance node is calculated, the node can be removed, resulting in another set of consequence nodes. The values of the new consequence nodes are equal to the value of the removed chance nodes. This process is repeated until only a single decision node remains.

Alternatives

The alternatives are levels of manpower as a percentage of assigned manpower assigned to Dyess AFB. Manpower levels are a discrete variable, but have a large number of possibilities. In order to create an operable tool, manpower levels were truncated. A 100 % manpower level is defined as no firefighters deployed. The minimum manpower level is defined as 10% because at the 10% manpower level, there is no benefit gained by even having an FES flight at Dyess AFB. A standard work cycle for

a firefighter is six 24-hour shifts with at least one day off in between workdays. After the sixth 24-hour shift, the firefighter receives a day off, called a Kelly day. Due to training, permanent change of station (PCS), temporary duty (TDY), administrative duties, manpower slots not filled, injury, Kelly days, etc., it is estimated that between 10% and 20% of firefighters not deployed will not be available for their standard shift (Jones, 2007). The 10% to 20% reduction in manpower available is referred to as normal absences. In addition to the normal absences, an additional five firefighters are not available for alarm response. These five positions are the shift chief and two emergency dispatchers per shift. These personnel were assumed to always be unavailable and were therefore, not considered in this analysis. Dyess AFB FES flight is divided into two shifts. A maximum 100 % manpower level is determined to be the maximum and a 10% manpower level is the minimum. The remaining alternatives were divided into 10% increments. Tables 3.1 and Table 3.2 show the manpower level breakdown for both 10% and 20% normal absences, respectively. Additionally, a decision tree with the manpower levels is presented on Figure 3.3.

Table 3.1: Manpower Distribution Chart 10% Normal Absences

Manpower Chart 10% Normal Absences				
Percentage of Manpower	Normal Manpower Available	Minus 5 (Dispatch/ Chief)	Available After Normal Absences	Manpower Available per Shift
100%	77.00	72.00	64.30	32.15
90%	69.30	64.30	57.37	28.69
80%	61.60	56.60	50.44	25.22
70%	53.90	48.90	43.51	21.76
60%	46.20	41.20	36.58	18.29
50%	38.50	33.50	29.65	14.83
40%	30.80	25.80	22.72	11.36
30%	23.10	18.10	15.79	7.89
20%	15.40	10.40	8.86	4.43
10%	7.70	2.70	1.93	0.96
0%	0.00	0.00	0.00	0.00

Table 3.2: Manpower Distribution Chart 20% Normal Absences

Manpower Chart 20% Normal Absences				
Percentage of Manpower	Normal Manpower Available	Minus 5 (Dispatch/ Chief)	Available After Normal Absences	Manpower Available per Shift
100%	77.00	72.00	56.60	28.30
90%	69.30	64.30	50.44	25.22
80%	61.60	56.60	44.28	22.14
70%	53.90	48.90	38.12	19.06
60%	46.20	41.20	31.96	15.98
50%	38.50	33.50	25.80	12.90
40%	30.80	25.80	19.64	9.82
30%	23.10	18.10	13.48	6.74
20%	15.40	10.40	7.32	3.66
10%	7.70	2.70	1.16	0.58
0%	0.00	0.00	0.00	0.00

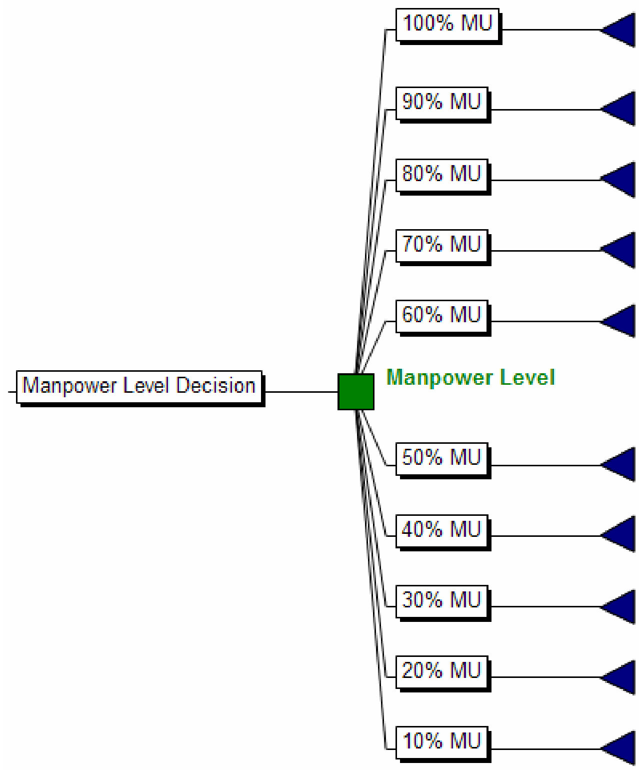

Figure 3.3: Decision Tree for Manpower Level

Risk Scenarios

An exhaustive list of risk scenarios must be developed to provide a complete risk analysis. Additionally, a requirement for using a decision tree is that each risk scenario must be mutually exclusive, meaning there is only one possible combination of outcomes. FES flights are very dynamic and cover a wide range of responsibilities. The list of possible risk scenarios is large and virtually impossible to develop. Therefore, the scenarios were categorized similarly to Kaplan and Garrick (1981). In order to categorize the risk scenarios for an FES flight, a complete list of FES responsibilities was created first. Each of these responsibilities is a category that represents multiple risk scenarios. Table 3.3 shows the list of Fire Protection Flight responsibilities created at the Fire Reshaping Conference (2006).

Table 3.3: FES Responsibility List (Fire Reshaping Conference, 2006)

Core Missions	**Non-Core Mission**
Firefighting	**Firefighting**
Aircraft	Wildland
Structural	Mutual Aid
Vehicle	Weapons Storage Area
Equipment	High-rise Building
Brush/Grass	Transient Aircraft
HAZMAT	**HAZMAT**
Offensive	Biological/Chemical/WMD
Defensive	Railway
	Public Highway
Rescue	**Rescue**
Fire	Water
Vehicle/Equipment	High Angle
HAZMAT	Fuel Cell/Tank
Confined Space	Trench
EMS Support	**EMS Support**
Sudden Illness	Basic Life Support
Injury	Advanced Life Support
	Transport

In order to reduce the combinatorial aspects of the tool, the DM wase asked to rank the responsibilities. An additional category "Other" is also created that includes all other risk scenarios. The DM was asked to determine and rank the three most important FES responsibilities in reference to manpower decisions at Dyess AFB. Consequently, all responsibilities not specifically modeled were considered part of the "Other" category. Table 3.4 shows this ranking.

Table 3.4: Top Three FES Responsibilities with Regards to Manpower (Jones, 2007)

Rank	FES Responsibility
1	Aircraft Response (Aircraft)
2	Structural Response (Structural)
3	Hazardous Material Response (HAZMAT)

The ranking resulted in four categories to be modeled: Aircraft Response, Structural Response, Hazardous Materials Response, and "Other" Response. The four categories are defined in Table 3.5.

Table 3.5: Risk Category Definitions

Risk Category	Definition
Aircraft	Any FES response, thought to be an emergency or potential emergency response, in which FES manpower is deployed in a manner consistent with Aircraft Rescue and Fire Fighting (ARFF).
Structural	Any FES response, thought to be an emergency or potential emergency response, in which FES manpower is deployed in a manner consistent with Structural Rescue and Response.
HAZMAT	Any FES response, thought to be an emergency or potential emergency response, in which FES manpower is deployed in a manner consistent with Hazardous Materials Rescue and Fire Fighting.
Other	An FES response, thought to be an emergency or potential emergency, for any reason outside of the reasons listed above.

It was assumed the categories were independent; meaning the likelihood of an occurrence in one category does not change the likelihood of an occurrence in another category. In order to insure the categories were independent, any alarm or response that is part of two categories was considered as a part of the initiating category. For example, if an aircraft fire starts a building on fire, the structural emergency was considered part of the aircraft emergency and therefore be counted under the Aircraft category. All

responsibilities that require FES manpower, but were not considered emergencies or potential emergencies, were assumed to be included in the normal absences. The risk categories were dissected further into two secondary risk categories. The secondary risk categories are listed and defined in Table 3.6.

Table 3.6 Secondary Category Definitions

Secondary Category	**Definition**
Yes	There is an alarm and it is an emergency or potential emergency in that risk category
False	There is an alarm, it is in that category, but there is no emergency or reasonable potential for an emergency for that alarm.

The result of combining the risk categories and secondary risk categories was eight sub-categories. These sub-categories are dichotomous, meaning they each have only two possible outcomes per risk scenario. The two outcomes are “Occur,” which means there was an occurrence of an alarm in that sub-category and “No,” which means there was no occurrence of an alarm in that sub-category. A risk scenario was defined as the combination of outcomes in the eight individual sub-categories. For example one possible outcome is: “Aircraft-Yes, Occurs” / “Aircraft-False, No” / “Structural-Yes, No” / “Structural-False, Occurs” / “HAZMAT-Yes, No” / HAZMAT-False, No” / “Other-Yes, Occurs” / “Other-False, Occurs.” The possible risk scenarios will be discussed further in the modeling step of the methodology. The eight dichotomous sub-categories per risk scenario resulted in 256 potentially unique risk scenarios and consequences per manpower level.

Consequences

Consequences were determined using the combination of historical data and the expert opinion of the DM. Historical data was used to determine the consequences for the average manpower level. It was assumed the historical consequence data represents the 100% manpower level alternative. Although manpower has fallen below the 100% level during the data collection period, it was considered a conservative estimate. From this data an expected cost per alarm in each sub-category was calculated. The remaining consequence data were determined by soliciting the DM's expert opinion. The DM was asked to determine manpower risk factors for each manpower level. A manpower risk factor is the factor that represents the increase in the consequences due to changes in the manpower level. Consequences were measured in the following two areas:

- Total Cost (TC) (Material Loss + Response Costs)
- Loss of Life (LOL)

Total cost (TC) is the sum of material loss and response costs. Material loss is the FES reportable dollar loss associated with the cost to repair, replace, or otherwise rectify a loss as a result of damage caused by an incident. Response costs are the costs of the response itself. They were reported in the Automated Civil Engineer System – Fire Department (ACES-FD) and they are the cost of manpower to respond and vehicle "wear and tear," based on the time of response (Jones, 2007). Loss of life (LOL) is the total number of fatalities sustained by firefighters and non-firefighters as a result of an incident.

In order to avoid unintentional weighting, the consequences were converted into the same units. The unintentional weighting is a result of loss of life being a relatively

small number compared to total cost. There was enough difference in the consequences that loss of life would have made a very minimal impact on the risk analysis if a common unit was not developed. The intention of this research was to allow the DM to determine the relationship between the consequences; therefore, the consequences need to be in common units. A linear single dimension value function (SDVF), Equation (3.3), was used to calculate a common unit for the consequences (Kirkwood, 1997). The SDVF is assumed to be linear to simplify the model. Justification for the assumption is provided in Chapter 2.

$$v\left(X_{i,j}\right)=\frac{Greatest(X_{i,j})-X_{i,j}}{Greatest\left(X_{i,j}\right)-Smallest\left(X_{i,j}\right)} \tag{3.3}$$

where:

$X_{i,j}$ represents the value of the consequence for S_i and consequence j

Greatest $(X_{i,j})$ represents the largest value for all S_i and consequence j

Smallest $(X_{i,j})$ represents the smallest value for all S_i and consequence j

$v(X_{i,j})$ represents the value of consequence $X_{i,j}$ in risk mitigation units

Equation (3.3) linear normalizes the consequences, meaning they have a value between 0 and 1. The equation converted the consequences from their original units, dollars and lives, to a constructed unit called risk mitigation. Risk mitigation units are defined as units that represent an FES flight's ability to mitigate the risk that falls within the list of the FES flight's responsibilities. In the case of the original units, dollars and lives, less is better; in the case of risk mitigation units, more is better. Therefore, the tree now changes from a minimization problem to a maximization problem.

Once the consequences were converted to a single unit, the trade-off values for the consequences were determined for the consequences and they were combined using a linear additive value function similar to Kirkwood (1997). One of the requirements of the additive value function is mutual preferential independence, meaning the value placed on a consequence does not depend on the value of the other consequence. Loss of life and total cost are preferentially independent of each other, therefore, the additive value function was used. The consequences were given weights and a single consequence was determined by using the additive value function seen in Equation (3.4) and Equation (3.5).

$$v(X_{C,i}) = \sum_{1}^{n} w_j v\left(X_{i,j}\right) \tag{3.4}$$

$$v(X_{C,i}) = w_{TC} v(X_{TC,i}) + w_{LOL} v(X_{LOL,i}) \tag{3.5}$$

where:

n represents the number of consequences

$v(X_{C,i})$ represents the combined single consequence value for S_i

w_j represents the weight of consequence j

w_{TC} represents the weight of the total cost consequence

w_{LOL} represents the weight of loss of life consequence

$v(X_{TC,i})$ represents the SDVF value of the total cost consequence for S_i

$v(X_{LOL,i})$ represents the SDVF value of the total cost consequence for S_i

To weight the consequences the DM was asked to determine a relative importance of each consequence. The weights were used in Equation (3.5) and a single consequence,

$v(X_C)$,was calculated for each risk scenario. The single consequence was entered into the decision tree for analysis. It was assumed the consequences from one event were not affected by the fact there was another event occurring. In addition, mutual aid assistance from outside departments was not considered in this model. However, incidents in which Dyess AFB provided mutual aid were modeled.

Cost/Benefit Consequence

An estimate was performed to calculate the cost of contractor labor. This cost, called contractor cost (CC) was calculated using estimates from a cost analysis completed by Dyess AFB in 2002 in the document Temporary (Intermittent) Firefighter Plan (2002). Dyess AFB FES flight has 77 permanently assigned firefighters, including normal absences. Therefore, a 10% difference in manpower was estimated at about 7.7 firefighters. The worst-case scenario was 59 shifts for a contract firefighter during a standard four-month deployment with 14 days of reconstitution time. The cost breakdown per contracted employee per deployment can be seen in Table 3.7.

Table 3.7: Cost Breakdown/Contracted Employee per Deployment (2002 dollars)

Cost Breakdown/Contracted Employee	**Sub-Value (2002)**	**Cost/ One Contracted Employee Over Entire Deployment (2002)**
Cost/24-Hour Shift		
$311.68	$311.68	
Cost of Training		
$890.40		$890.40
Cost of Outfitting		
$2,833.41		$2,833.41
Cost of Books		
$30.00		$30.00
Worst Case 24-Hour Shift Total		
59	59	
Total Hour Cost		
59 x $311.68		$18,389.12
Total Cost/Contracted Employee For Deployment		$22,142.93
Number Contractors Representing 10%		
7.7	7.7	
Total Cost Contractor to Raise Manpower by 10% **7.7 x $22,142.93**		**(2002 Dollars)** **$170,500.56**

The contractor cost (CC) to replace 10% of the FES manpower was therefore estimated to be $170,500.56 (2002 dollars). In order to convert to 2007 dollars, an inflation index was used. The Deputy Assistant Secretary for Cost and Economics (SAF/FMC) is required to publish USAF inflation indices annually. SAF/FMC (2007) uses Equation (3.6) to calculate raw inflation rates.

$$II = i * (1 + Rate_{i+1}) * (1 + Rate_{i+2}) * ...(1 + Rate_{i+n}) \tag{3.6}$$

where:

II represents the Inflation Index for the desired year

i represents the base year as a 1.0 (2002)

$Rate_{i+1}...Rate_{i+n}$ represents the change in inflation rate between years

n represents desired year of inflation index – base year (2007 – 2002)

The operations and maintenance, non-pay, non-POL raw inflation index was used for the conversion to 2007 dollars. The inflation rate factor is 1.11917291394 (SAF/FMC). The 2007 contractor cost to replace 10% of the FES manpower is $170,500.56 * 1.11917291394 = $190,819.61. This amount is the total for an entire deployment. Because the time frame being analyzed was one 24-hour shift, it was divided by the number of 24-hour shifts during a deployment. The estimation used was 134 days; therefore, the contractor cost per 24-hour shift for a deployment is $190,819.61 / 134 = $1,424.03

The contractor cost is preferentially dependent on the expected risk mitigation value (ERM), meaning the value the DM places on money spent for contract firefighters changes for different ERM values. The additive value function, Equation (3.4), requires mutual preferential independence; therefore, an additive value function was not used to combine contractor cost and ERM into the single consequence. Instead, a series of pareto optimal graphs were created to represent the cost/benefit relationship.

Likelihood

Likelihood per 24-hour period was calculated using the Poisson distribution. Poisson distributions are used to determine the likelihood of a given number of incidents over a time period. The equation to calculate Poisson likelihood is shown in Equation (3.7) and the equation used to determine λ_i is shown in Equation (3.8).

$$P(A_i = k) = \frac{e^{-\lambda} * \lambda_i^{\ k}}{k!} \tag{3.7}$$

$$\lambda_i = \frac{N_i}{D_i} \tag{3.8}$$

where:

A_i represents the number of alarms in sub-category i

k represents an integer greater than or equal to zero

$P(A_i=k)$ represents the probability that $A_i=k$

λ_i is the expected number of alarms in a sub-category i

N_i is the number of responses in a sub-category i

D_i is the total number of time periods in which the N_i data was collected

The N_i values were determined using historical data and D_i was the number of days over which the N_i data was collected. After N_i and D_i were determined, λ_i was calculated for each sub-category. The Poisson likelihood was determined for $P(A_i=0)$ representing no alarms in the 24-hour time period. Each chance event of a decision tree must be mutually exclusive; meaning the sum of all the probabilities must equal one. Therefore, $1 - P(A_i=0)$ was used as the likelihood of the occurrence of at least one alarm in the 24-hour time period. However, it is assumed that all $P(A_i>0)$ have the same consequence regardless of the value of A_i. Once the risk categories and the modeling technique were identified, the decision was be modeled. The first part of modeling the decision is developing an influence diagram.

Decision Models

Influence Diagram

An influence diagram was used to provide a simple, visual representation of the model. Precision Tree (2004) software was used to create the influence diagram. In this software, a rectangle represents a decision or an alternative, a circle represents a chance node or a category and the associated likelihood and consequences, a rectangle with rounded corners represents a calculation, and a diamond represents the desired outcome. The influence diagram can be seen in Figure 3.4. For the purposes of this research, the influence diagram is a reference only and will not be used for calculation.

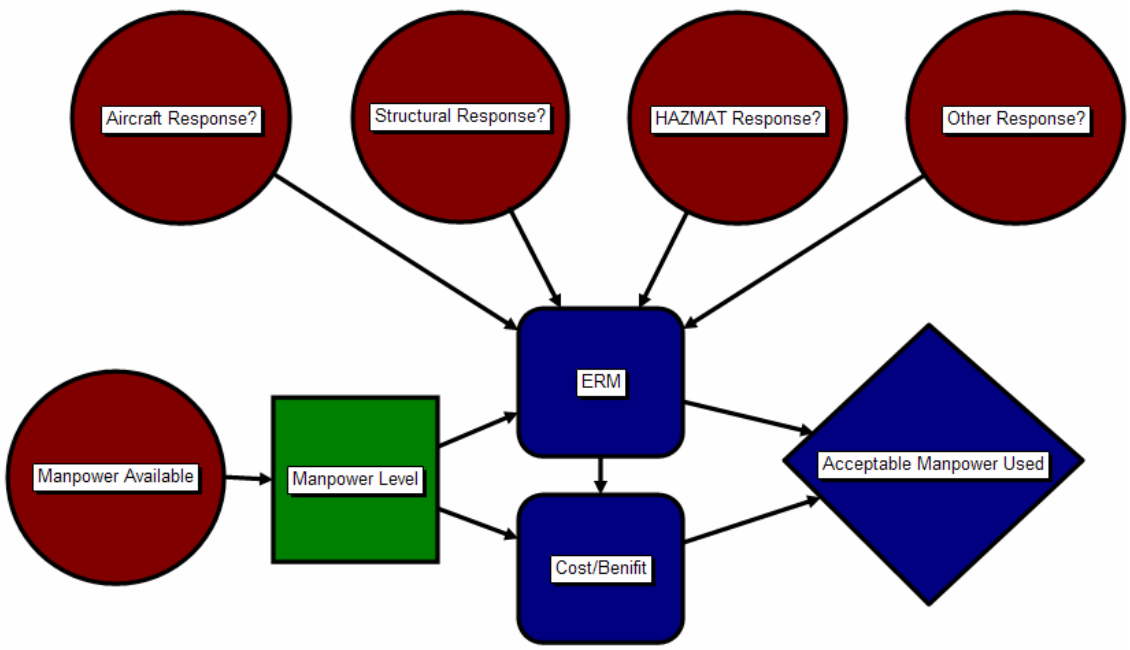

Figure 3.4: Influence Diagram

Decision Tree Models

The second part of the modeling process was creating the decision tree. A decision tree was created from the influence diagram. The resulting decision tree was too large and therefore, it was divided into sections. The two sections are the Aircraft and Structural risk sub-category tree and the HAZMAT and "Other" risk sub-category tree. Each termination node in the Aircraft and Structural risk sub-category tree is linked to a unique HAZMAT and "Other" risk sub-category tree. In addition, each manpower level has potential for unique consequences. There are ten manpower levels in each model for a total of 2,560 potentially unique single consequences, $v(X_C)$, per model. The decision tree more clearly illustrates a risk scenario as being any combination of "Occur" or "No" over the eight sub-categories. The likelihood of a risk scenario is the product of the outcome's likelihood and the consequence is a summation of the $v(X_C)$ for each of the sub-categories. A sample of the Aircraft and Structural risk sub-category tree and the HAZMAT and "Other" risk sub-category tree can be seen in Figure 3.5 and Figure 3.6, respectively.

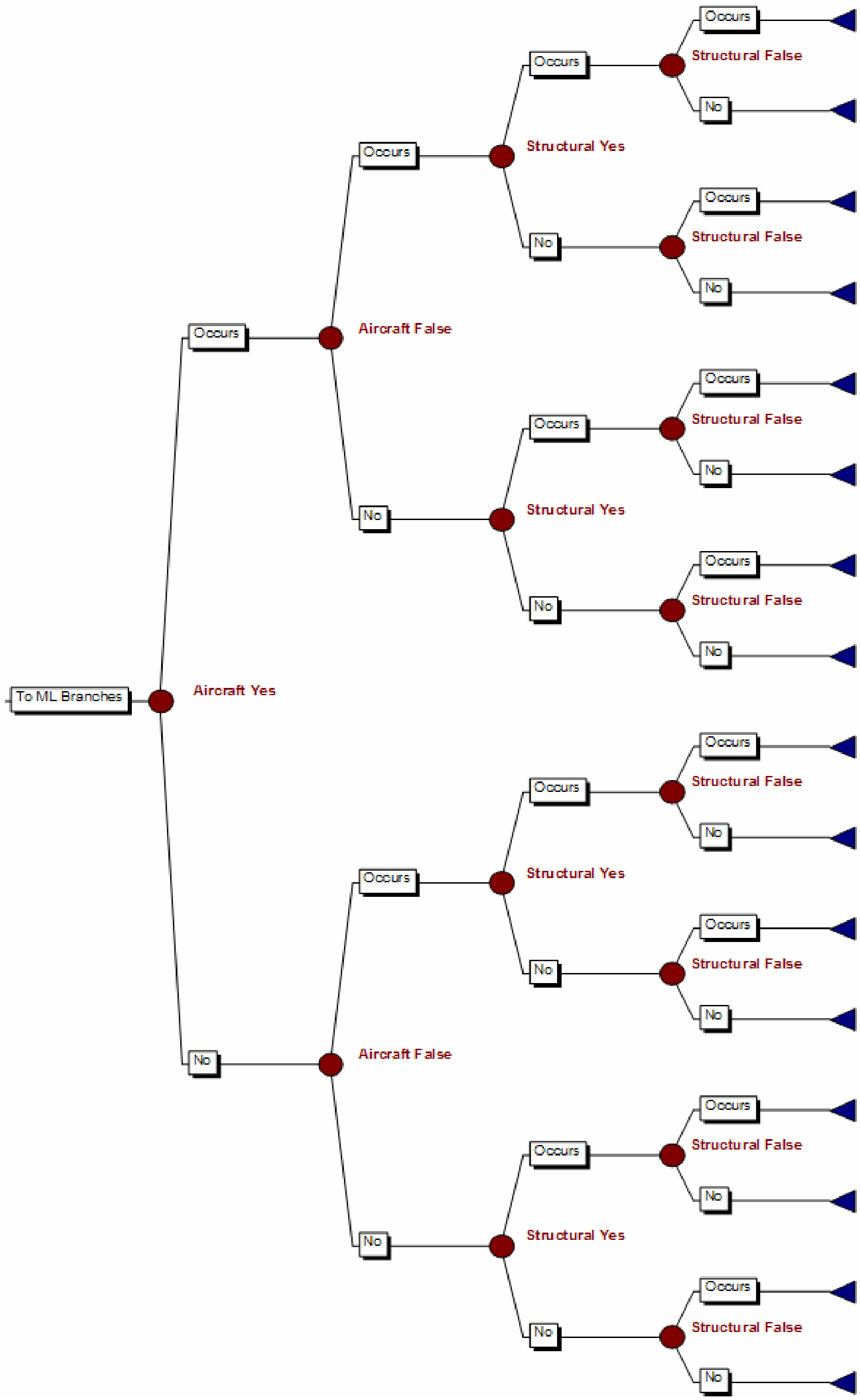

Figure 3.5: Aircraft and Structural Risk Sub-Category Tree

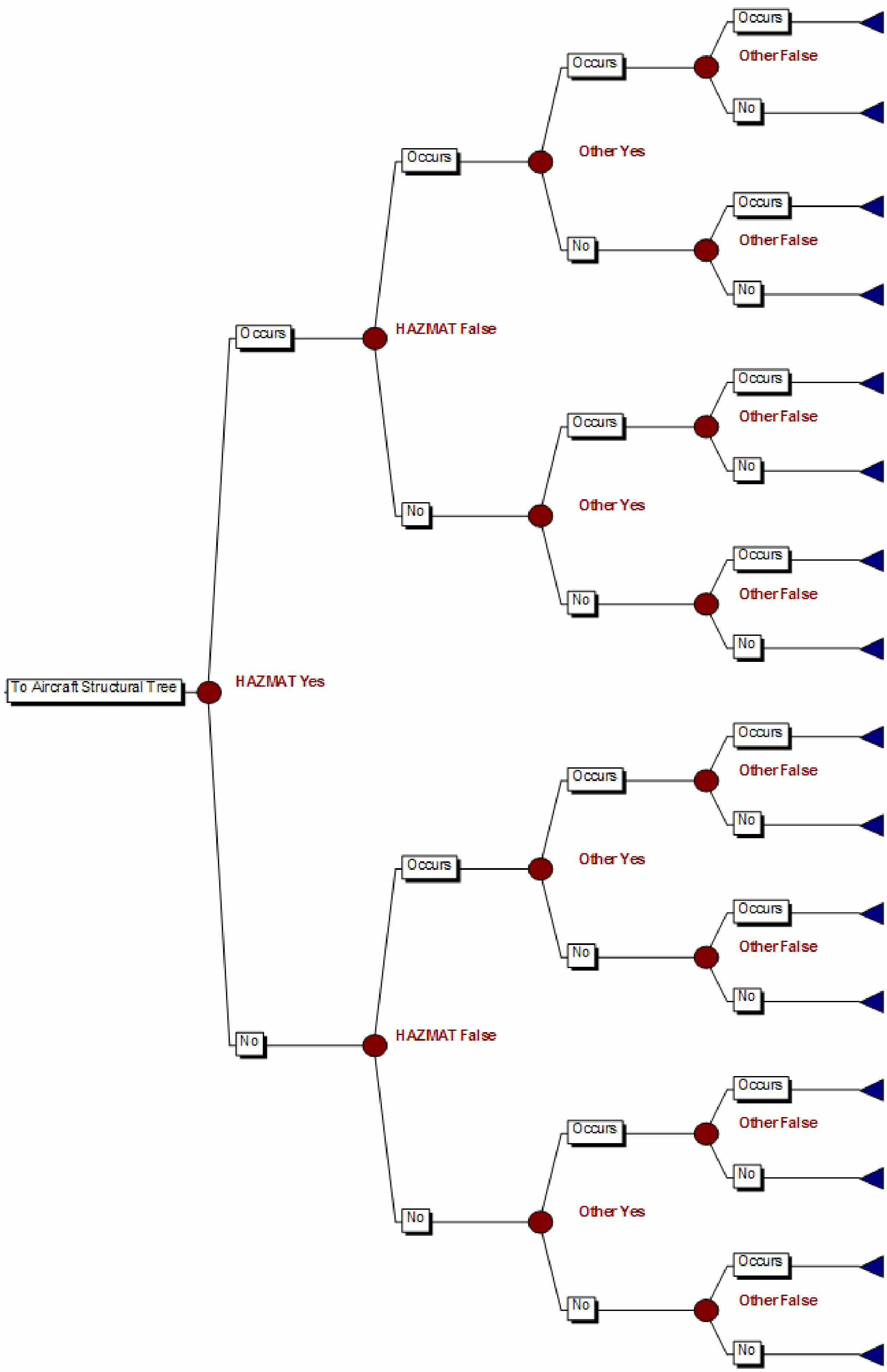

Figure 3.6: HAZMAT and Other Risk Sub-Category Tree

Decision Rules

The information was presented to the decision maker in two ways. The first way was the expected risk mitigation values (ERM). ERM is calculated by "rolling back" the tree and determining the expected value of risk mitigation. The second way was the results of a cost/benefit analysis. A cost/benefit was calculated by using the cost to raise the manpower available level through the use of contract firefighters, to the manpower level. It assumed a one to one exchange between deployed FES manpower and contracted manpower. Both ERM and cost/benefit are presented in tabular form and via pareto optimal graphs.

Sensitivity Analysis

Sensitivity analysis was used to check the decision tree's sensitivity to variation in the likelihood, consequence, or weighting data. The goal of sensitivity analysis is to determine what values could cause a change in the preferred solution. However, in this research, the attempt was to provide insight to the DM to allow for a more informed decision. Therefore, sensitivity analysis was used to determine what uncertainties the expected risk mitigation value was most sensitive too.

Summary

The methodology and the model were completed. The next step was to collect the data and population the model. The model was then run and the results were analyzed. Chapter 4 is a discussion of data collection and the results. Chapter 5 provides a discussion of the results.

IV. Results and Analysis

Introduction

There are three purposes for this chapter. The first purpose, is to collect data from the test organization. The test organization is the Fire and Emergency Services (FES) flight at Dyess Air Force Base (AFB). The second purpose is to apply the methodology discussed in Chapter 3 to the test case. The third purpose is to analyze the results and run sensitivity analysis.

Data Collection

Data was collected from a variety of sources. Additionally, both objective and subjective data was used. Subjective data was collected from the decision maker (DM), the Deputy Fire Chief for Dyess AFB's FES flight. He is a subject matter expert (SME) with 27 years firefighting experience, more importantly, has 25 years firefighting experience at Dyess AFB. Historical data was collected from the National Fire Incident Reporting System (NFIRS), Automated Civil Engineer System-Fire Department (ACES-FD), The Naval Safety Center, and internal data kept at Dyess AFB. All USAF installations are required to input FES incident information into NFIRS as of 1 January 2006. The FES Reshaping Conference (2006) estimates NFIRS data and ACES-FD data to be 95% accurate over range in which data was collected.

Manpower Risk Factor

Manpower risk factors are subjective measures that measure the change in consequences due to the change in manpower. Since the range of normal absences (NA) was estimated between 10% and 20%, manpower risk factors were collected at both the

10% and 20% NA level. The DM was asked to determine the change in risk as the manpower level (ML) level decreased. The assumptions were normal working hours (no overtime), no mutual aid received and a time frame of one 24-hour shift during a 134-day deployment.

The DM stated that the risk would not increase until response capability fell below National Fire Protection Association (NFPA) standards. The standards require an 18-man crew response to an Aircraft emergency and a 12-man crew to both a Structural and HAZMAT emergency. The response estimated for an “Other” emergency was a 4-man crew. A 4-man crew was chosen because most of the responses in the “Other” category require only a rescue truck and a fully manned rescue truck requires four firefighters. In addition, the FES flight has “staff” positions or positions within the FES flight where personnel are assigned duties outside of normal firefighting shift work. The DM determined that most “staff” positions could be placed into firefighting roles, for the length of a deployment, without increasing the risk. However, five staff positions must always remain to perform the dispatch and command and control duties (Jones, 2007). The results of the correspondence can be seen on Table 4.1 and Table 4.2 for the 10% and 20% normal absence, respectively.

Table 4.1: Manpower Risk Factor Data for 10% Normal Absences (Jones, 2007)

Increase Factor on Consequences for Manpower Levels (10% Normal Absences)								
Manpower Level (%)	Aircraft		Structural		HAZMAT		Other	
	LOL	TC	LOL	TC	LOL	TC	LOL	TC
100	-	-	-	-	-	-	-	-
90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
70*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
60**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50**	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00
40	1.40	1.20	1.20	1.00	1.40	1.00	1.00	1.00
30	1.60	1.40	1.40	1.20	1.70	1.30	1.00	1.00
20	1.80	1.60	1.80	1.50	2.00	1.60	1.00	1.00
10	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
0	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

*** Start Folding in "Staff" for Aircraft**

**** Start Folding in "Staff" for Structural and HAZMAT/No "Staff" Remain for Aircraft**

***** No "Staff" Remain for Structural and HAZMAT**

Table 4.2: Manpower Risk Factor Data for 20% Normal Absences (Jones, 2007)

Increase Factor on Consequences for Manpower Levels (20% Normal Absences)								
Manpower Level (%)	Aircraft		Structural		HAZMAT		Other	
	LOL	TC	LOL	TC	LOL	TC	LOL	TC
100	-	-	-	-	-	-	-	-
90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
70*	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
60**	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50**	1.40	1.20	1.00	1.00	1.00	1.00	1.00	1.00
40	1.60	1.40	1.20	1.10	1.40	1.10	1.00	1.00
30	1.70	1.50	1.40	1.20	1.70	1.30	1.00	1.00
20	1.90	1.70	1.80	1.50	2.00	1.60	1.00	1.00
10	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
0	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

*** Start Folding in "Staff" for Aircraft**

**** Start Folding in "Staff" for Structural and HAZMAT/No "Staff" Remain for Aircraft**

***** No "Staff" Remain for Structural and HAZMAT**

A value of 1.0 as a manpower risk factor means there is no change in the consequence from the 100% manpower level and a value of 2.0 means there is a 100% increase from the 100% manpower level. To determine the consequence for a sub-category and a specific manpower level, the corresponding manpower risk factor is multiplied by the consequence for 100% manpower level. For example, to determine the consequence for 20% normal absence, aircraft loss of life consequence, and 40% manpower available, the 100% consequence was multiplied by 1.60.

Likelihood Data

The likelihood data was calculated using the Poisson distribution and the Poisson likelihood equations shown in Equation (3.6) and Equation (3.7). Historical data from the ACES-FD database was used to determine the number of responses (N_i). The ACES-FD data between 1 January 2004 and 25 January 2007 (1120 days) was compiled and the data was broken down by sub-category (Brown, 2007; Jones, 2007). A summary of the number of responses (N_i) can be seen on Table 4.3. A complete list of the ACES-FD data can be seen in Appendix A.

Table 4.3: Summary of ACES-FD Number of Responses Data

Summary of ACES-FD Number of Responses Data (1 January 2004 to 25 January 2007)								
Total Responses	3107							
Aircraft Response		Structural Response		HAZMAT Response		Other Response		Omitted
Yes	False	Yes	False	Yes	False	Yes	False	Total
569	962	474	490	111	54	249	26	172

The 172 items that were omitted in Table 4.3 were training performed by the FES flight. This training was deleted from the number of responses data because training was

already accounted for in the normal absence calculations. D_i was determined to be 1120 for all sub-categories because that was the number of 24-hour shifts over which the N_i data was collected. Once the N_i and the D_i were determined, Equation (6) and Equation (7) were used to calculate λ_i, $P(A_i=0)$, and $1 - P(A_i=0)$. In decision trees the branches of a chance event must be mutually exclusive. Calculating the likelihood using the method stated above maintains the mutual exclusivity, but it does combine the $P(Ai \geq 1)$ into the "Occur" branch for each sub-category. Although there is a likelihood associated with more than one alarm in a sub-category, it was assumed the consequences were the same for all likelihood $1 - P(A_i=0)$. Table 4.4 shows a summary of the likelihood data.

Table 4.4: Summary of the Poisson Distribution Likelihood Data

Summary of Likelihood Data Using Poisson Distribution (1 January 2004 to 25 January 2007)								
Total Number of Days 1120								
	Aircraft Response		Structural Response		HAZMAT Response		Other Response	
	Yes	False	Yes	False	Yes	False	Yes	False
λ_i	0.50804	0.85893	0.42321	0.43750	0.09911	0.04821	0.22232	0.02321
$P(A_i=0)$	0.60168	0.42362	0.65494	0.64565	0.90565	0.95293	0.80066	0.97705
$1 - P(A_i=0)$	0.39832	0.57638	0.34506	0.35435	0.09435	0.04707	0.19934	0.02295

Total Cost (TC) Consequence Data 100% Manpower Level

Historical data was collected for the total cost (X_{TC}) consequence. It was assumed the historical X_{TC} data was the data for the 100% manpower level. All of the consequence data was a direct measure, with the exception of the proxy or indirect measure for the "HAZMAT-Yes, Occur" material cost consequence. The historical data was averaged and assumed to be the consequence for the "Occur" outcome 100% manpower level sub-categories. The average total cost for a sub-category was equal to

the response cost for the sub-category plus the material cost for the sub-category. By definition the "No" outcome, for each sub-category, had no total cost consequence. A summary of the X_{TC} can be seen in Table 4.9.

Response Cost

Response costs are as reported in ACES-FD which calculates response costs monetarily as a function of manpower and "wear and tear" on the vehicle costs (Jones, 2007). The categorized ACES-FD data discussed earlier was used for the calculation of the response cost consequences and is summarized in Table 4.5.

Table 4.5: Summary of ACES-FD Response Cost Data

Summary of ACES-FD Response Cost ($) Data (1 January 2004 to 25 January 2007)								
Aircraft Response		Structural Response		HAZMAT Response		Other Response		Omitted
Yes	False	Yes	False	Yes	False	Yes	False	Total
57,190.50	129,415.28	24,795.80	22,360.22	9,359.64	3,462.56	7,813.31	1,417.29	14,220.68

A complete list of the ACES-FD data and breakdown can be seen in Appendix A. An average response cost per sub-category occurrence was calculated. The average response cost per sub-category was calculated by dividing the total response cost (Table 4.5) by the number of sub-category occurrences (Table 4.3). A summary of the response cost data for 100% manpower level can be seen on Table 4.9.

Material Cost

The material cost for the "Aircraft-Yes," "Structural-Yes," and "Other-Yes" alarm occurrences was calculated using a fire loss database maintained by Dyess AFB's FES flight (Jones, 2007). A query was performed over the time frame (1 January 2004 to 24 January 2007). The material cost for HAZMAT could not be measured in the same manner as the other material costs. Dyess AFB's FES flight is responsible for containment of HAZMAT emergencies. Therefore, cost is not tracked by the FES flight. It was determined that a reasonable material cost for HAZMAT responses in terms of the FES flight's responsibility was the total cost of clean-up supplies used (Jones, 2007). The cost data for clean-up supplies could only be tracked for one year. The 2006 cost data for clean-up supplies was obtained from the contractor responsible for supplying Dyess AFB with the materials (Brigham, 2007). By definition, there is no material loss for "False" alarms occurrence. Table 4.6 summarizes the material cost results.

Table 4.6: Material Cost Summary

	Material Cost Data (Losses in Data Range)			
	Aircraft ($)	**Structural ($)**	**HAZMAT* ($)**	**Other ($)**
	7,000,000.00	10,000.00	650.00	75.00
	20,000.00	300.00	457.60	
		50,000.00		
Totals	7,020,000.00	60,300.00	1,107.60	75.00

* Data for only one year (2006)

An average response cost for “Aircraft-Yes,” “Structural-Yes,” and “Other-Yes” alarm occurrences was calculated by dividing the total response cost (Table 4.6) by the number of sub-category occurrences (Table 4.3). The ACES-FD database recorded 41 HAZMAT “Yes” alarms in 2006. Using 41 “Yes” occurrences and the total response cost in Table 4.6, an average material cost consequence for the “HAZMAT-YES” occurrence sub-category was calculated. A complete breakdown of the 2006 ACES-FD HAZMAT data can be seen in Appendix B. A summary of the response cost data for 100% manpower level can be seen on Table 4.9.

Loss of Life (LOL) Consequence Data 100% Manpower Level

Fortunately, Dyess AFB has not lost a life reportable by the FES flight. However, this does not mean the risk is not present. The loss of life consequence (X_{LOL}) data was collected from the Naval Safety Center. The Naval Safety Center maintains all of the Department of Defense FES databases. The USAF database maintained by the Naval Safety Center has data from 1984 to present. From 1984 to 2003 the data is stored in a database called the Safety Information Management System (SIMS) and from 2002 to present; the data is stored in the NFIRS. There is a one-year overlap because the database change was not instantaneous. This may cause some overlap in data, but the overlap should be minimal (Lisa, 2007). The database was queried from 1 January 1984 to 13 February 2007. Table 4.7 summarizes the results of the query.

Table 4.7: Loss of Life Data from the Naval Safety Center (Lisa, 2007)

Loss of Life (LOL) Data with Total				
	Aircraft	Structural	HAZMAT	Total
LOL SIMS	91	32	1	375
LOL NFIRS	0	0	0	67
Total LOL	**91**	**32**	**1**	**442**
Incidents SIMS	60,683	9,947	25,901	642,711
Incidents NFIRS	77,749	1,128	24,192	376,480
Total Incidents	**138,432**	**11,075**	**50,093**	**1,019,191**

By definition there are no loss of life consequences in the “False, Occurs” or any of the “No” sub-categories. The NFIRS data showed that 94,267 or approximately 25% of the total incidents were “False” alarms. The Other incident LOL data was collected by removing the 25% false alarms and the Aircraft, Structural, and HAZMAT incidents. Table 4.8 summarizes the loss of life consequences for all four categories.

Table 4.8: Loss of Life Data Calculating the “Other” Category (Lisa, 2007)

Loss of Life (LOL) Data with "Other"				
	Aircraft	Structural	HAZMAT	Other
Total LOL	91	32	1	318
Total Incidents	138,432	11,075	50,093	564,793

The data in Table 4.8 was used to average the loss of life consequences by dividing the total loss of life per sub-category by the total number of incidents per sub-category. Table 4.9 summarizes the average loss of life consequence data as well as all of the average total cost data for 100% manpower level.

Table 4.9: Consequence Data for 100% Manpower Level

100% Manpower Likelihood and Raw Consequence Data					
		Cost/Alarm			
Category	Sub - Category	Response Cost	Material Cost	Total Cost	Loss Of Life per Alarm
Aircraft	Yes	$100.51	$12,337.43	$12,437.94	0.000657
	No	-	-	-	-
	False	$134.53	-	$134.53	-
Structural	Yes	$52.31	$127.22	$179.53	0.002889
	No	-	-	-	-
	False	$45.63	-	$45.63	-
HAZMAT	Yes	$84.32	$27.01	$111.34	0.000020
	No	-	-	-	-
	False	$64.12	-	$64.12	-
Other	Yes	$31.38	$0.30	$31.68	0.000563
	No	-	-	-	-
	False	$54.51	-	$54.51	-

Consequences for Remaining Manpower Levels

The consequences for the 100% manpower levels were assumed to be the historical data shown on Table 4.9. The consequences for the remaining manpower levels are found by multiplying the manpower risk factors (Table 4.1 and Table 4.2) with the 100% manpower consequences for each sub-category. A complete list of the 20% normal absence consequence data can be seen in Appendix C.

Using the Single Value Dimension Function (SDVF)

When the loss of life and total cost consequences were analyzed separately the result was 256 risk scenarios for each of the ten manpower levels, for a total of 2,560 risk scenarios. Because of the large number of consequences, from this point forward this study only analyzed the conservative estimate of 20% normal absence. The methodology is the same regardless of the normal absence level.

In order to put the loss of life and total cost consequences in the same terms, a linear single dimension value function (SDVF), as shown in Equation (3.3), was used to calculate X_{LOL} and X_{TC}. The SDVF requires the calculation of the *Greatest* (X_i) and *Smallest* (X_i) variables for loss of life and total cost. The *Greatest* (X_{LOL}) was determined by finding the risk scenario, represented by the tree, with the greatest aggregated value for loss of life. The *Greatest* (X_{TC}) was determined in the same manner as *Greatest* (X_{LOL}), but for the total cost consequence. After running these scenarios it was determined the *Greatest* (X_i) for both loss of life and total cost occurred at the 10% manpower level when all eight alarms occurred ("Aircraft-Yes, Occurs" / "Aircraft-False, Occurs" / "Structural-Yes, Occurs" / "Structural-False, Occurs" / "HAZMAT-Yes, Occurs" / HAZMAT-False, Occurs" / "Other-Yes, Occurs" / "Other-False, Occurs."). The *Greatest* (X_{LOL}) was 0.00826 and the *Greatest* (X_{TC}) *was* \$26,118.56. Therefore, the *Greatest* (X_{LOL}) was estimated to be 0.009 and the *Greatest* (X_{TC}) was estimated to be \$27,000.00.

The *Smallest* (X_i) was determined in the same manner as the *Greatest* (X_i) with the exception of determining the smallest value for loss of life and total cost. The smallest value was a "No" outcome for all eight sub-categories. This resulted in a *Smallest* (X_{TC}) and a *Smallest* (X_{LOL}) equal to zero. Table 4.10 shows a portion of the results for $v(X_{LOL})$ and $v(X_{TC})$ at the 10% manpower level.

4.10: Sample of Additive Value Function and SDVF for 10% ML and w_{TC}=0.50

Risk Scenarios for 10% ML (1 ="Occur"; 0 ="No")								Single Consequence Data (w_{TC} = 0.5)				
Aircraft		Structural		HAZMAT		Other						
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC}	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$
1	1	1	1	1	1	1	1	$26,118.56	0.03265	0.00826	0.08228	0.05746
1	1	1	1	1	1	1	0	$26,009.54	0.03668	0.00826	0.08228	0.05948
1	1	1	1	1	1	0	1	$26,055.20	0.03499	0.00713	0.20740	0.12119
1	1	1	1	1	1	0	0	$25,946.18	0.03903	0.00713	0.20740	0.12321
1	1	1	1	1	0	1	1	$25,990.32	0.03740	0.00826	0.08228	0.05984
1	1	1	1	1	0	1	0	$25,881.30	0.04143	0.00826	0.08228	0.06186
1	1	1	1	1	0	0	1	$25,926.96	0.03974	0.00713	0.20740	0.12357
1	1	1	1	1	0	0	0	$25,817.94	0.04378	0.00713	0.20740	0.12559
1	1	1	1	0	1	1	1	$25,895.89	0.04089	0.00822	0.08671	0.06380
1	1	1	1	0	1	1	0	$25,786.87	0.04493	0.00822	0.08671	0.06582
1	1	1	1	0	1	0	1	$25,832.53	0.04324	0.00709	0.21183	0.12754
1	1	1	1	0	1	0	0	$25,723.51	0.04728	0.00709	0.21183	0.12956
1	1	1	1	0	0	1	1	$25,767.65	0.04564	0.00822	0.08671	0.06618
1	1	1	1	0	0	1	0	$25,658.62	0.04968	0.00822	0.08671	0.06820
1	1	1	1	0	0	0	1	$25,704.29	0.04799	0.00709	0.21183	0.12991
1	1	1	1	0	0	0	0	$25,595.26	0.05203	0.00709	0.21183	0.13193

As can be seen from the table, the problem now is a maximization problem with the constructed units of risk mitigation units. In this table a value of "1" represents an "Occur" outcome in that sub-category and a value of "0" means there is "No" outcome in that sub-category. The first four numbers represent the Aircraft and Structural sub-categories and the last four represent the HAZMAT and "Other" sub-categories. Therefore, each of the 256 risk scenarios has a unique 8-digit identifier. Manpower level and w_{TC} to clearly identify which set of risk scenarios are being discussed.

Additive Value Function Weights

The next step was to calculate a single consequence for each risk scenario. The first step was to determine the weights for the additive value function shown in Equation (3.4) and Equation (3.5). An attempt was made to solicit these weights from the DM. However, the DM was unable to determine the weights. In general, FES flights are concerned more with loss of life (X_{LOL}) than with total cost (X_{TC}), but that is not always

the case. Dyess AFB FES flight's primary responsibility is to the mission at Dyess AFB. This may create a situation where an incident with no potential for loss of life takes precedence over an incident where there is potential loss of life. There may also be a situation with a small potential total cost takes precedent over a situation with a larger potential total cost. Therefore, the weights can range from 0 to 1 for both w_{TC} and w_{LOL}. The analysis was run for five different values for w_{TC}. These values were w_{TC} = 0, 0.25, 0.50, 0.75, and 1. Because the sum of the weights must be equal to one, $w_{LOL} = 1 - w_{TC}$.

Determining a Single Consequence (X_C)

Once the consequences have been converted into risk mitigation units and the additive value function weights have been determined, a single consequence can now be determined using Equation (5) and Equation (6). There are 2,560 risk scenarios if the consequences are analyzed separately. Because there are five possible values being considered for w_{TC}, once the consequences are combined using an additive value function the number of potentially unique consequences increases to 12,800. Table 4.10 shows a sample of the v(X_c) values for the 10% manpower level and a w_{TC} = 0.50. A complete list of the 20% normal absence single consequences can be seen in Appendix D.

Model

The model can now be populated. Figure 4.1 is the Aircraft and Structural sub-category tree for 10% manpower level and a w_{TC} = 0.5. The consequence values in the Aircraft and Structural figure come from the combination with the HAZMAT and "Other" trees. Figure 4.2 shows one of the HAZMAT and "Other" sub-category trees for the 10% manpower level and a w_{TC} = 0.5.

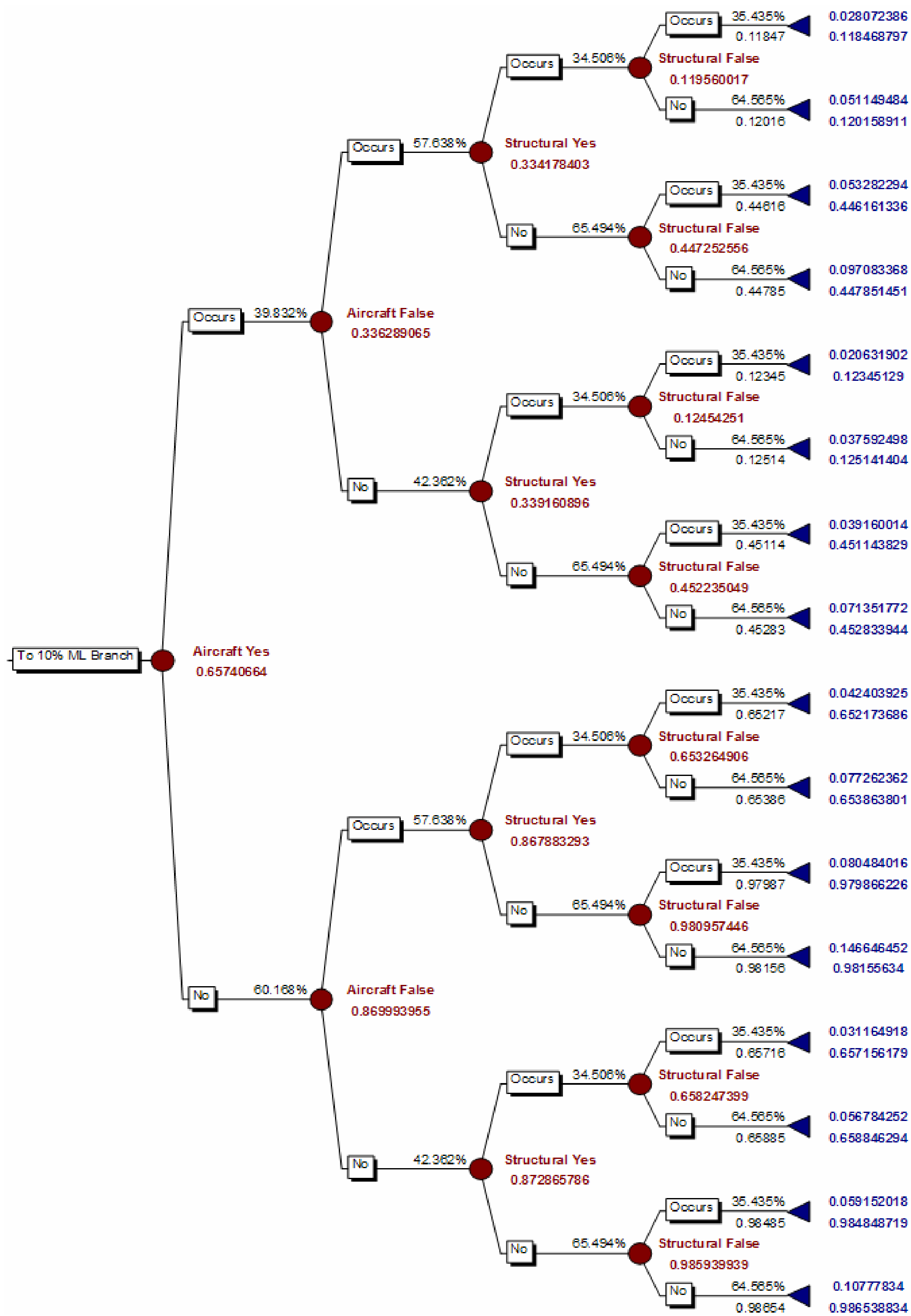

Figure 4.1: Aircraft and Structural Sub-Category Tree (10% ML and w_{TC}=0.50)

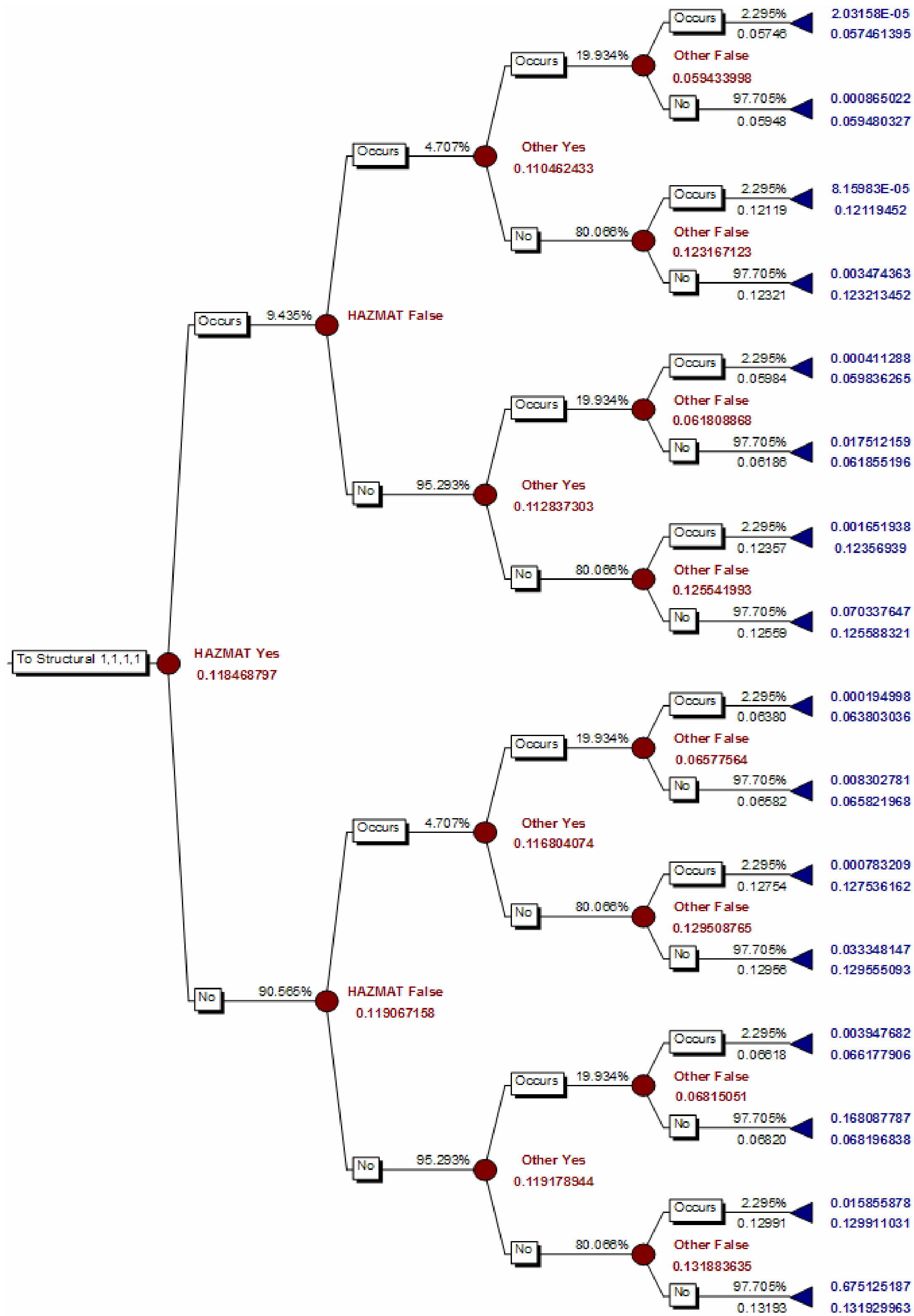

Figure 4.2: HAZMAT and "Other" Sub-Category Tree (10% ML and w_{TC}=0.50)

The HAZMAT and “Other” sub-category trees’ (see Figure 4.2 for example) consequences are populated using the $v(X_C)$’s calculated with the additive value function (see Table 4.10 for example). Each HAZMAT and “Other” sub-category tree corresponds to a specific branch on the Aircraft and Structural sub-category tree. Figure 4.2 has a four digit binary identifier that designates a unique branch on the Aircraft and Structural sub-category tree. This identifier corresponds to the first four digits in Table 4.10 and means the same thing as the digits in that figure. For example, the 1,1,1,1 identifier in Figure 4.2 corresponds to the branch on the Aircraft and Structural sub-category tree that has the outcome sequence “Aircraft-Yes, Occurs” / “Aircraft-False, Occurs” / “Structural-Yes, Occurs” /Structural-False, Occurs.” The HAZMAT and “Other” sub-category trees are also potentially unique to manpower level and the value of w_{TC} because both of the manpower level and w_{TC} can affect the result of the additive value function. A complete list of the consequence data can be seen in Appendix D.

Results

The decision tree was “rolled back,” as described in Chapter 3, and the expected risk mitigation (ERM) per 24-hour shift was calculated. The ERM’s for the different manpower levels and w_{TC}’s are shown on Table 4.11.

Table 4.11: ERM's for Varying w_{TC} Values

Manpower Level	ERM for 20% Normal Absence				
	w_{TC} = 0	w_{TC} = 0.25	w_{TC} = 0.50	w_{TC} = 0.75	w_{TC} = 1
10%	0.69489	0.67615	0.65741	0.63866	0.61992
20%	0.73243	0.71876	0.70509	0.69143	0.67776
30%	0.78262	0.76598	0.74934	0.73269	0.71605
40%	0.80775	0.78958	0.77141	0.75324	0.73507
50%	0.83581	0.82003	0.80425	0.78847	0.77269
60%	0.84163	0.83371	0.82579	0.81788	0.80996
70%	0.84745	0.83807	0.82870	0.81933	0.80996
80%	0.84745	0.83807	0.82870	0.81933	0.80996
90%	0.84745	0.83807	0.82870	0.81933	0.80996
100%	0.84745	0.83807	0.82870	0.81933	0.80996

If risk was the only concern, the manpower levels that give the maximum ERM are 60% and greater for w_{TC} = 1 and 70% for all other values of w_{TC}. Figure 4.3 shows that, in general, as the manpower level increases the ERM will also increase. However, there is a point where additional manpower level no longer increases the ERM. Figure 4.3 also appears to show that w_{TC} = 1 gives the most conservative estimate for ERM and there is no increase for ERM above 60% manpower level. However, the remaining manpower levels do show an increase in the ERM from 60% to 70% manpower level. This is due to the ability of Dyess FES flight to prevent loss of life, specifically in "Aircraft-Yes, Occurs" sub-category, which increases when the manpower level increases from 60% to 70%. Therefore, if loss of life in "Aircraft-Yes" alarms is a major concern, w_{TC} = 1 may not be the best way to determine manpower. Understanding what causes of the differences in ERM can help the DM to determine the acceptable level of risk.

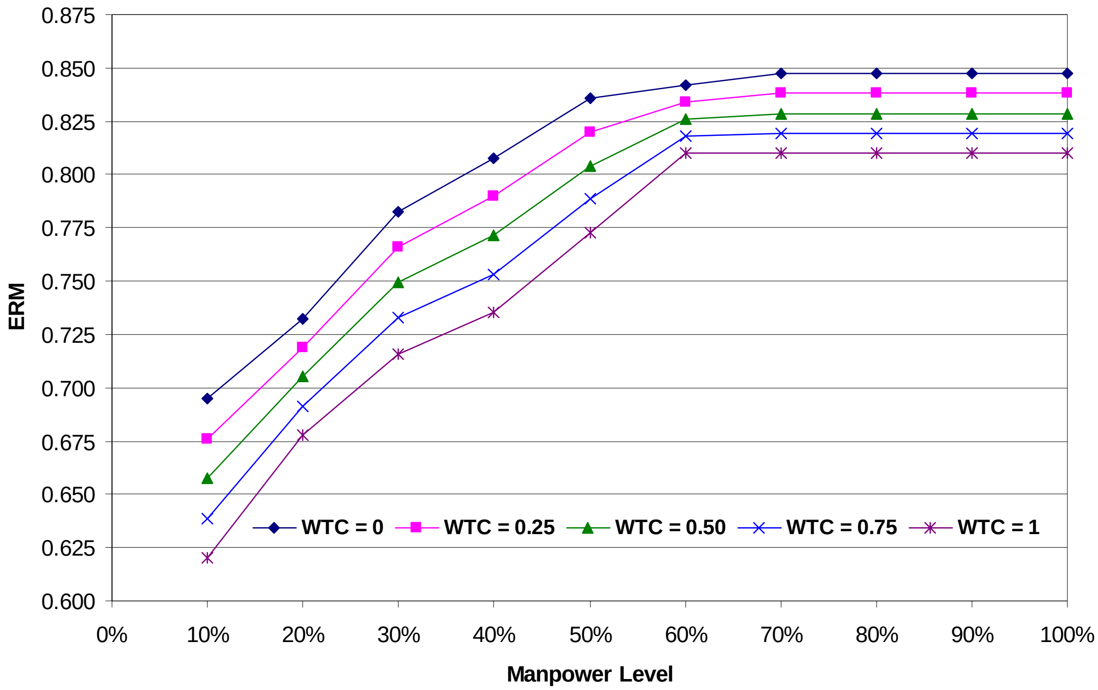

Figure 4.3: ERM's for Varying w_{TC} Values

Table 4.12 shows the percent increase in ERM between each manpower level for varying levels of w_{TC}. The purpose of this table is to present the information to the DM in another way. The tables answer the question, "How much does ERM increase or decrease for different scenarios?" This type of data can be beneficial when discussing capability with other leadership who may not be familiar with the many of the activities an FES flight is involved in.

Table 4.12: Increase in ERM Between ML for Varying w_{TC}'s

Manpower Level Increase	Percent Increase in ERM				
	w_{TC} = 0	w_{TC} = 0.25	w_{TC} = 0.50	w_{TC} = 0.75	w_{TC} = 1
10% to 20%	5.40%	6.30%	7.25%	8.26%	9.33%
20% to 30%	6.85%	6.57%	6.27%	5.97%	5.65%
30% to 40%	3.21%	3.08%	2.95%	2.80%	2.66%
40% to 50%	3.47%	3.86%	4.26%	4.68%	5.12%
50% to 60%	0.70%	1.67%	2.68%	3.73%	4.82%
60% to 70%	0.69%	0.52%	0.35%	0.18%	0.00%

It is important to remember the percentage increase in Table 4.12 is for a 24-hour period. The table shows there is not a large increase in the step from the 60% to 70%. As the weight on total cost becomes more important, this gap decreases. When loss of life is heavily weighted the increase from 60% to 70% is at its highest. However, it is still only a slight difference. In addition, when loss of life is weighted heavily, the gap between the 50% and 70% manpower level is small. Analysis of Table 4.11, Table 4.12, and Figure 4.3 shows that maintaining manpower around 60% during a deployment will not cause a significant drop in ERM. However, these figures are being analyzed without considering the contractor cost.

Cost/Benefit Analysis

The analysis accomplished up to this point included total cost and loss of life, but excluded the cost for an FES flight to have the manpower available (MA). The cost to have manpower available, or contractor cost, is determined as the cost to replace FES manpower with contractors. In other words, during a deployment a fire chief may only have a limited number of firefighters available. Contractor cost is the cost to increase the manpower available, using contract firefighters, to the desired manpower level. The

contractor cost is determined by using a 2002 Dyess AFB cost estimate. The 2002 estimate was created to determine the cost of replacing Dyess AFB firefighters during a deployment. The estimate was then converted into 2007 dollars. The calculations can be seen in Chapter 3. The contractor cost estimate for replacing 10% of the FES flight's labor is $1,424.03. The cost/benefit analysis was only performed for the 20% normal absence and the values of w_{TC} were varied similarly to earlier analysis.

Contractor cost cannot be combined with the other consequences because of preferential dependency problems. This means the willingness to bring on contractor firefighters varies with different levels of ERM. The DM is probably more willing to spend money to raise a low and dangerous ERM than he is to raise the ERM from 60% to 70%. Additive value functions cannot be used when there is no preferential dependence. Therefore, contractor cost was pareto optimally graphed versus ERM. Figures 4.4 through Figure 4.9 show the pareto optimal graphs for varying manpower available, the respective ERM's, contractor cost, and varying values of w_{TC}. The graphs are intended to visually present the DM with the available options and to provide him with more detailed information to make manpower decisions. An example would be a situation where the DM is short manned and encounters a shift with a large potential for loss of life. The DM can get the information from the graph with the representative W_{LOL}. The data for these graphs can be seen in Appendix E.

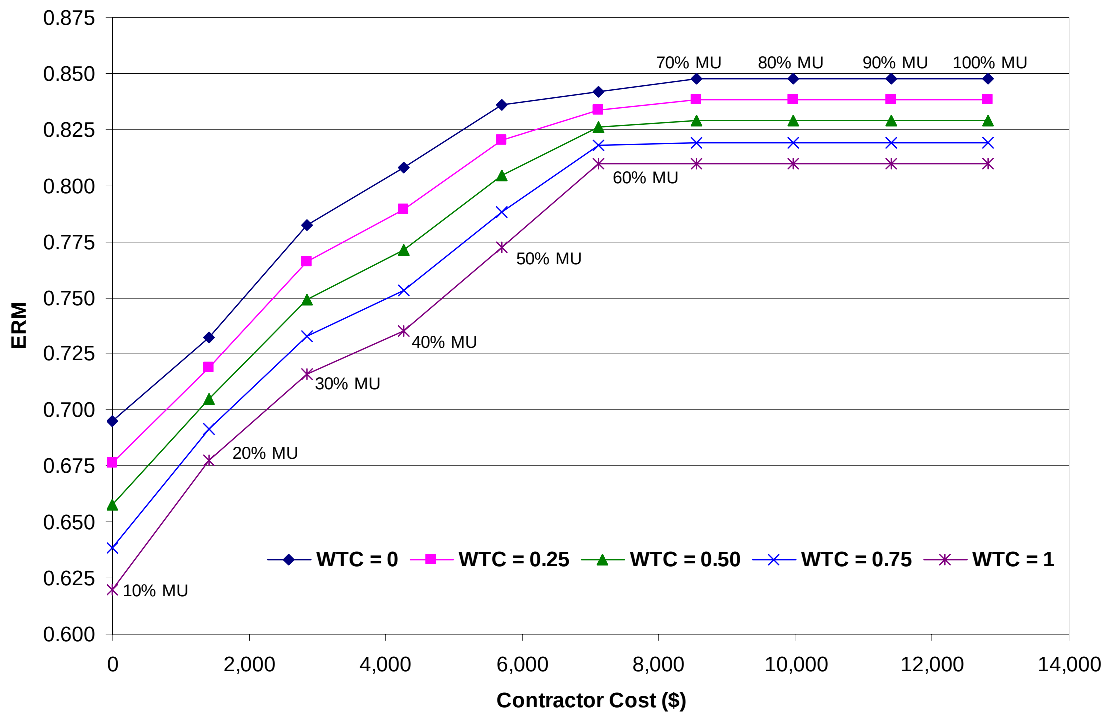

Figure 4.4: Pareto Optimal Graph for 10% Manpower Available

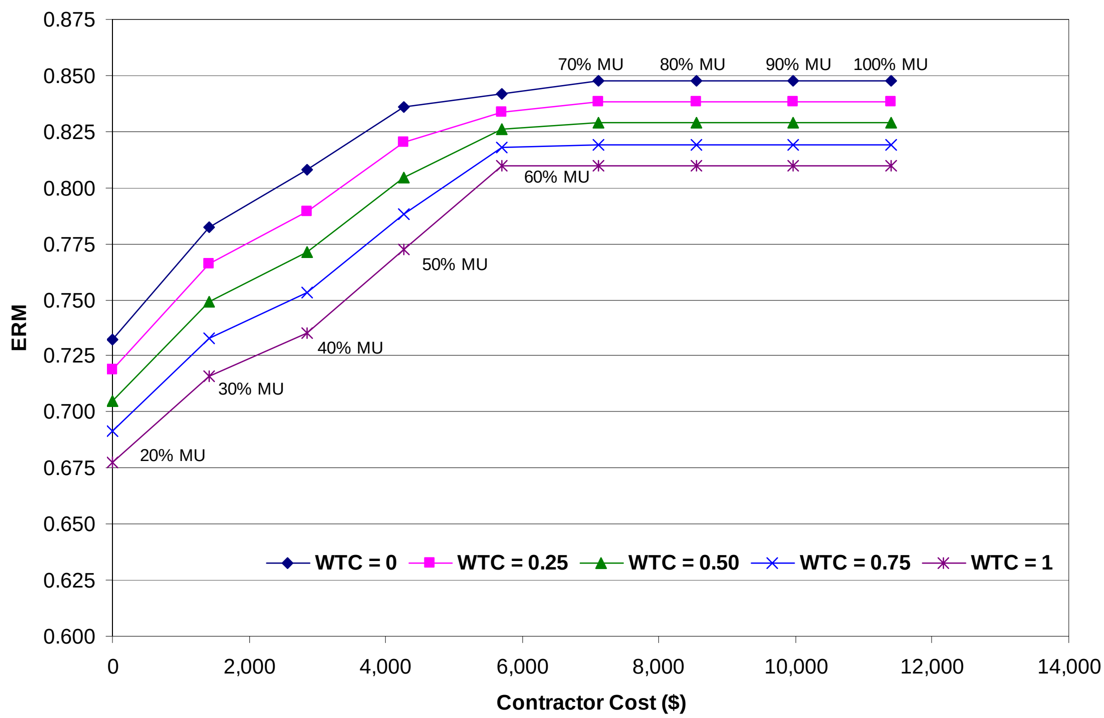

Figure 4.5: Pareto Optimal Graph for 20% Manpower Available

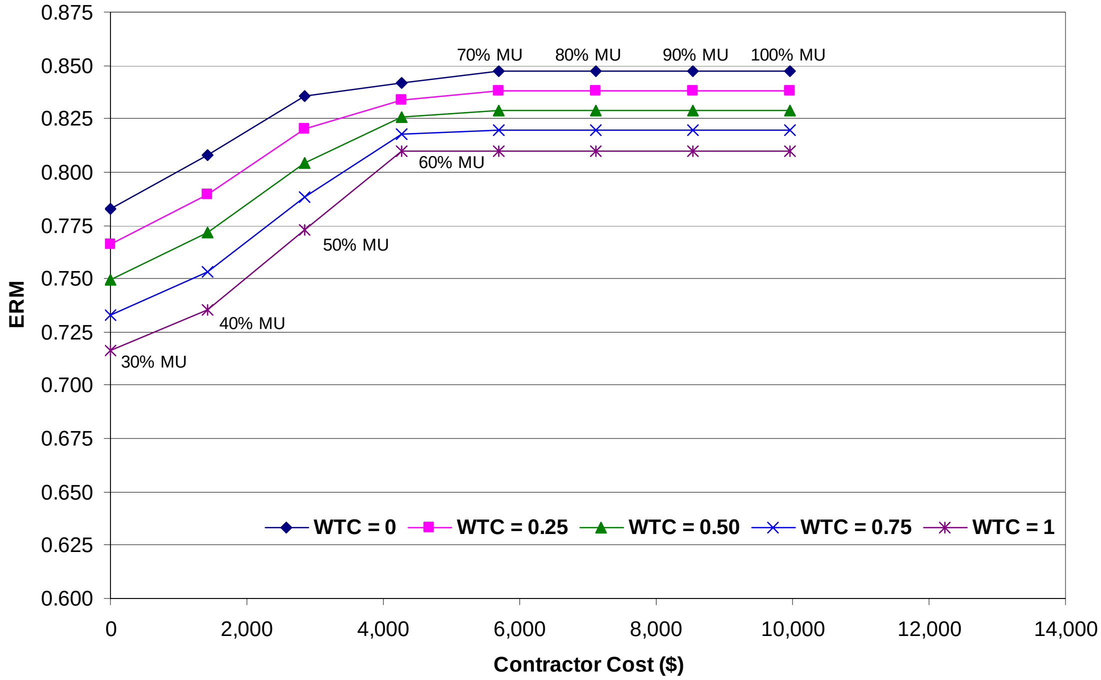

Figure 4.6: Pareto Optimal Graph for 30% Manpower Available

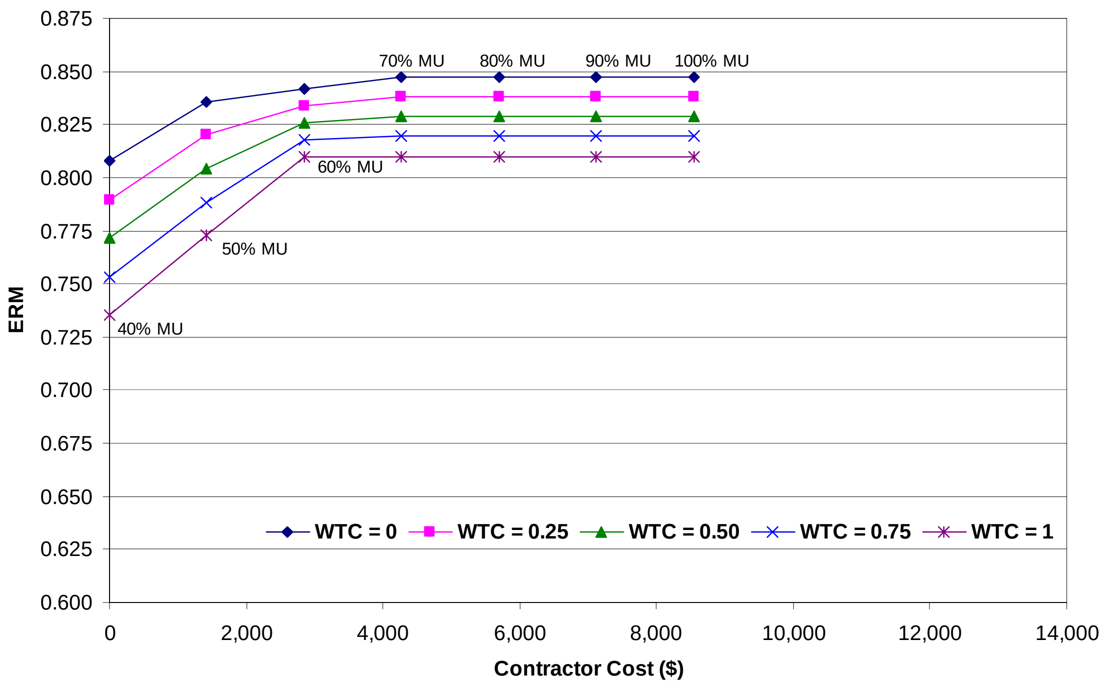

Figure 4.7: Pareto Optimal Graph for 40% Manpower Available

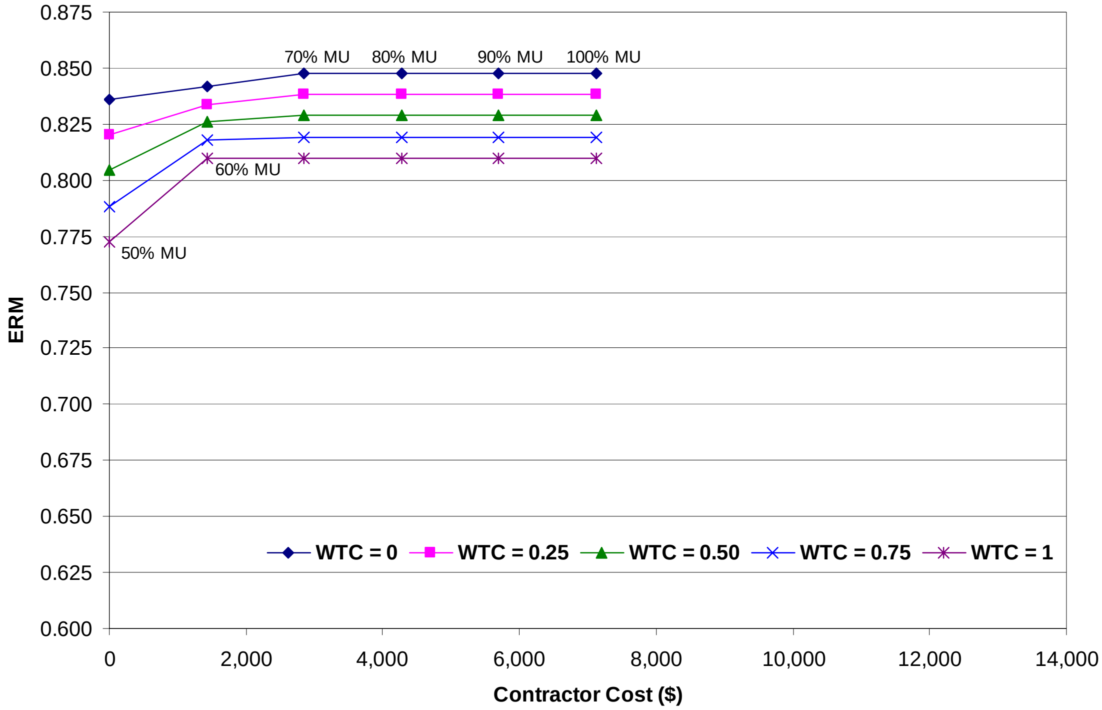

Figure 4.8: Pareto Optimal Graph for 50% Manpower Available

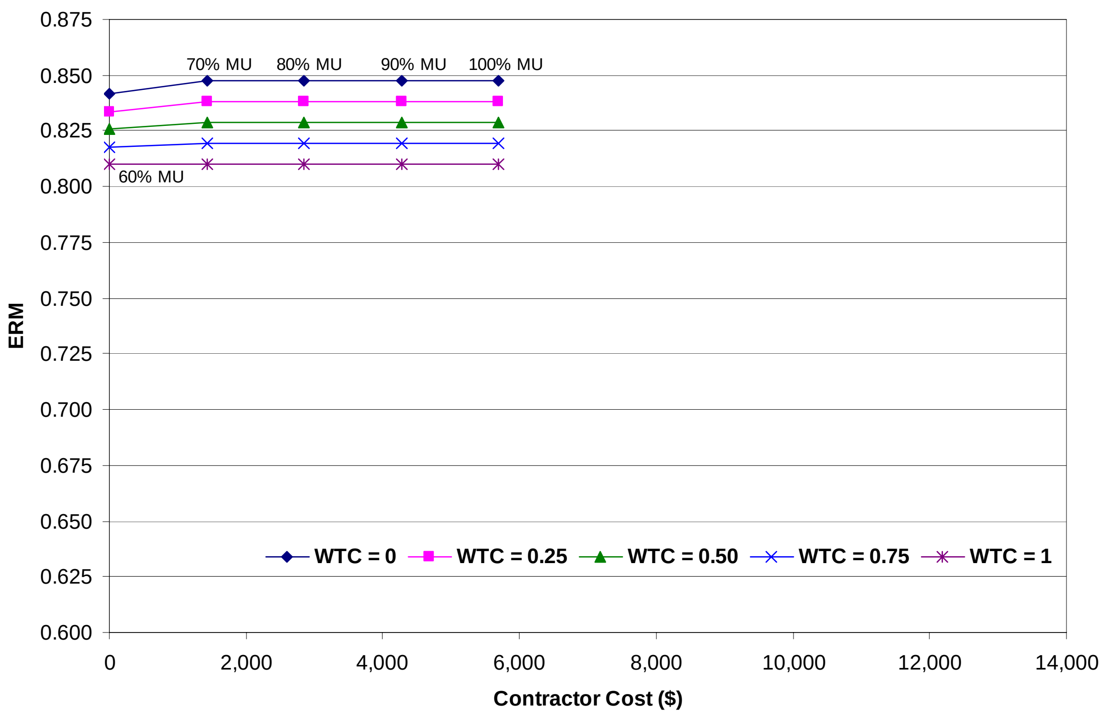

Figure 4.9: Pareto Optimal Graph for 60% Manpower Available

The graphs are similar to the ERM results. In general, as cost increases, the ERM also increases. However, after 70% manpower level, there is no added ERM benefit to spend more money on contractor labor. The cost/benefit graphs suggest the same solutions as the ERM. There is little ERM gain between the 60% and 70% manpower level, and a greater than $1,400 increase in contractor cost. In addition, the graph begins to level off around the 55% manpower level. The most benefit occurs between 55% and 65% using the results of the pareto optimal graphs.

Sensitivity Analysis

There was a great deal of uncertainty associated with the model. Normally, sensitivity analysis is performed to determine how changes to uncertainty in the model may affect the preferred solution. However, this model was not intended to suggest one preferred solution. This research was intended to provide the DM with a risk based decision tool to aid him in developing a workable solution for problems with high levels of uncertainty.

It is assumed if manpower is increased, the worst case is that the ERM will remain the same. Risk will never be increased with increases in manpower. However, many changes to the model may affect the ERM. The ERM is very sensitive to changes in the manpower risk factors. This is a subjective measure and careful attention should be paid to ensure the factors are determined logically. In addition to the subjectivity of the measure, an assumption was made that taking “staff” workers out of their normal jobs and placing them in traditional firefighting shift work will not increase the risk. This assumption was made because the “staff” workers are trained firefighters; the time frame for analysis was relatively short, one day for the analysis and only 134 days if it had to be

sustained for the whole deployment, and the DM felt there was enough downtime on the job for the "staff" to perform their normal duties. For the Aircraft category, staff workers begin to be rolled in at 70% manpower available level and are exhausted by the 60% manpower available level. For the Structural and HAZMAT categories they are rolled in at 60% and exhausted by the 50% manpower level (Jones, 2007). If this assumption proves false, the ERM could decline sharply. The assumption was based on very sound logic, but it is something to continue to analyze and manage. In addition to underestimating ERM, overestimating ERM will decrease the ERM, but may also unnecessarily use funds that could be better spent in other areas.

Another area where the model can be sensitive is change to the normal absence rate. This is because increasing normal absences decreases the personnel per shift; this in turn can lead to failure to meet the National Fire Protection Association (NFPA). The DM based the manpower risk factors on those NFPA standards. Therefore, increases in the normal absences can lead to increases in the manpower risk factors. The model is very sensitive to those changes as previously discussed. Part of the sensitivity to normal absences is caused by truncating the manpower levels. The manpower may not be available at the 60% manpower level, but is available at the 62% manpower level. The DM is very satisfied that 20% normal absence is a conservative estimate on the maximum value of normal absence for a deployment or a given day, but it is also possible to be too conservative and again consume resources needed elsewhere.

While other factors affect the ERM, the ERM is less sensitive to these changes because of the large time frame the data were collected over. Over three years of data and approximately 3,000 alarms were analyzed to determine the uncertainties. Changes

to the total cost, loss of lives, and number of responses create little impact on ERM or λ because they are averaged over a large number of events. In addition, because the Poisson distribution was used, changes in the time frame will not affect the likelihood distribution. If only a small data population is available for analysis with this model, ERM may be more sensitive to changes in these areas.

Discussion of Results

The primary goal of this research was to validate a methodology for a risk based decision tool. The situation chosen to validate the decision tool was a potential future deployment at Dyess AFB. This model proved operable for this representative case. Actual usable data was produced. From the ERM, it appears that during a deployment, the Fire Chief would not see a significant drop in risk until after the 60% manpower level for a 24-hour shift. The cost/benefit relationship added further support to this conclusion showing that, although there was not a large increase in ERM, there was a cost of about over $1,400 associated with an increase from the 60% to 70% manpower level. This is especially true since the normal absence rate analyzed is considered conservative. With normal absences being conservative, the DM can probably count on some of those firefighters being available for work. If the extreme case happens, overtime can be used to fill the void. In addition, mutual aid received was not considered in the model. If the base has a mutual aid agreement with surrounding agencies, this could create a decrease in ERM. However, the sensitivity analysis suggested that close attention should be paid to the manpower risk factors and they probably need to be managed and reanalyzed on a relatively frequent basis. It is important to note that a 60% manpower level, assuming a

20% normal absence rate, may not restrict the FES flight from responding to Aircraft-Yes alarms with the 18-man team required by the NFPA (Jones, 2007)

Summary

In this chapter a methodology to develop a risk based decision tool to assist USAF FES flights with manpower planning for short manning situations caused by deployments was analyzed. The representative case to test the methodology was a potential Dyess AFB deployment. The methodology worked as conceived and resulted in an operable decision tool that produced usable results. The chapter included data collection, consequence aggregation, a risk model based on manpower, and a cost benefit analysis. Chapter 5 summarizes the results and addresses some the research questions stated in Chapter 1.

V. Conclusion

Background

The purpose of this study was to create a risk based decision tool to assist in manpower level decisions for firefighting organizations. The research focused on modeling risk in terms of manpower for United States Air Force (USAF) Fire and Emergency Services (FES) flights. FES flights are dynamic organizations charged with preserving life and property from a variety of unpredictable emergencies. Modeling the risk to an organization presented an enormous challenge. In order to model the risk, this study had to draw from a wide range of risk assessment and decision analysis concepts. The first attempt at accomplishing this research was to model all of the responsibilities of FES flights. FES flights proved to be too dynamic to make this model operable.

The methodology may be valid over a larger group of organizations, but the model had to be developed for a specific representative situation. The situation decided on was a deployment at Dyess AFB in Texas. The deployment situation was chosen because the USAF is in a time of very high operations tempo and deployments are common. Many organizations have to deal with short manning situations, but manpower shortages are most evident in organizations responsible for public safety and the protection of multi-million dollar assets.

Even modeling this specific situation was a challenge, but a workable model was developed. Once the workable model was developed, it performed very well. The output was a series of pareto optimal graphs showing the risk to manpower and the cost/benefit relationships. These graphs provide quantitative insight that can be quickly referenced by the decision maker (DM) in a short manning situation.

One of the goals of the research was to create the methodology for application in all USAF FES flights and in the bigger picture all fire departments and potentilly all first responder organizations. The model developed is very specific to Dyess AFB. The methodology succeeded at representing the risk at Dyess AFB and was intended to be flexible enough to allow for use on other USAF installations. Therefore, the methodology will allow for the modeling of different USAF FES flights. In fact, risk scenario generation began with a list of responsibilities created specifically to represent the responsibilities of all USAF installations and deployments, which affect many, if not all, USAF installations.

The methodology appears to be applicable to municipal fire departments, as well. Some obvious changes would have to be made in terms of deployments and the list of responsibilities, but otherwise, it would appear to be valid. In bigger cities with many responses and multiple stations, or in organizations where personnel serve multiple roles (i.e. personnel are both firefighters and police officers), even more changes or assumptions would have to be made to apply this methodology. The results show the methodology is a reliable framework for quantitatively analyzing manpower levels versus risk. This research for this study did not explore other first responder organizations in enough depth to make to determine the applicability on other first responder organizations. Therefore, the methodology is unproven on other first responder organizations. However, the methodology does appear to be usable for making analytical manpower decisions in any organization where the risk to the public and property has a relationship to the manpower level

The remainder of this chapter will explore four areas. The first is to use the model to investigate the validity of some of the USAF assumptions and ideas that were discovered through research. The second portion of this chapter will be recommendations. The third section will be research strengths and limitations, and the final section presents ideas for future research.

Analyzing USAF Assumptions

One Major Event Assumption

One USAF assumption with manpower is only one major structural, aircraft, or HAZMAT event will occur at a given time (AFI 32-2001, 1999). This model did not prove this assumption valid or false. The likelihood of an event is determined for one 24-hour period and the model did not differentiate whether events were simultaneous or not. The model did allow for the possibility of simultaneous events. However, the consequences were assumed independent and were not affected by the probability of simultaneous events. Although the model itself did not differentiate there was a substantial data collection done at Dyess AFB.

This research and past knowledge of Dyess AFB has uncovered three structural emergencies that could be considered major response (a kitchen fire, a utility shop fire, and a wildland fire), three HAZMAT emergencies (all JP-8 fuel spills with one involving serious injury), and two major aircraft emergencies. None of these events occurred simultaneously. The probability of having two "Yes" events (Aircraft, Structural, or HAZMAT) in a day is only 66%. In addition, almost all fire chiefs that were consulted for this research indicate their installations have mutual aid agreements with the local municipalities. Therefore, the assumption, although not a fact, is probably a safe

assumption for manpower. However, it is not a safe assumption when calculating risk. There is a risk of it occurring and that needs to be accounted for in the risk analysis.

FES Flights Manpower is Determined by Aircraft Emergencies

The FES Reshaping Conference (2007) stated that the core FES manpower number of 55 firefighters is based on the number of firefighters needed to man the trucks for a certain level aircraft response. This number of firefighters is multiplied by a manpower factor and this factor is supposed to account for normal absences, command and control, alarm shop personnel, deployments, and other staff positions. However, Aircraft response alone does not dictate FES manpower, the USAF manning document (AFMS 44EF) allows for positive variances for installations with larger buildings and bomb ranges.

Is this a good way to man a FES flight? The answer to that question can only be answered in terms of whether the factor does indeed account for all of those firefighting and “staff” positions. If so than according to the analysis, it is a good way to determine manpower at Dyess AFB. A true aircraft emergency requires that 18 firefighters respond, and according to the analysis, the consequences at Dyess AFB of a structural or HAZMAT emergency, do not increase until manpower falls below 12. Therefore, if Dyess AFB is manned for an aircraft emergency in the manner described above, it should be adequately covered for all other emergency types. However, assuming aircraft emergencies only is not an appropriate method to estimate risk.

Matrix Relating Manpower to Impact

Air Combat Command (ACC) developed a matrix relating manpower to impact (Kennedy, 2007). This matrix, Table 1.1, relates a manpower percentage level to risk,

FES impact and emergency scene impact. Based on this research, this matrix would be a very conservative estimate for Dyess AFB. At the 70% manpower level, the ACC matrix reports critically manned. This study determined at 70% manned, Dyess AFB FES flight was fully capable during a deployment. The remaining manpower levels on Table 1.1 appear to be equally as conservative.

Strengths and Limitations of Research

One of the main strengths of this research is that it took a very dynamic and complicated problem and simplified it, but maintained an adequate level of accuracy. The results turned out as intended and they are easy to read and understand. Another one of the strengths is the use the Poisson distribution. Poisson distributions allow the model to be put in terms of any time frame desired. It also allows for historical data, not random data, to influence the likelihood.

This research has a number of limitations. One area of concern is in the consequences. One limitation is the use of subjective data to calculate consequences. Historical data was used for the 100% manpower level, but the remaining manpower levels were calculated using the subjective manpower risk factors. Compounding this concern is the fact that the model is most sensitive to this measure. This makes the model susceptible to over- or under-estimating, either intentionally or unintentionally. Another area of concern is the material consequences. The only data available was data reportable by the Dyess FES flight. Dyess AFB FES only reports damage from actual fires, in addition to that, they only report fire damage for fires they extinguish or have some other role in. The non-reportable fire damage should be accounted for as FES risk, but it is not accounted for in the model.

The methodology has limitations as well. The first limitation is the likelihood of more than one alarm in a sub-category. The Poisson distribution allows for this, but this model assumes the consequence is the same regardless of the number of alarms. Another limitation is that the model assumes the consequences are the same, even if another emergency is occurring. The model does not allow for the increase in consequences in one emergency due to the fact that FES manpower is responding to another. The size of the model is a limitation. The model has 12,800 potentially unique risk scenarios. Using a spreadsheet model, these consequences can be arranged so there is very little data entry. However, there are still many places where errors can be introduced. The final limitation is the use of a constructed unit. A linear single dimension value function was used to normalize the consequences in terms of constructed unit. This may make potential beneficiaries of the methodology more resistant to using it.

Areas of Future Research

One area that needs future research is the development of the consequences. To start, a method should be developed to make the manpower risk factors more objective, or completely replace them with an objective measure. It would also be advantageous if consequences could be found that would allow for the formulation of a preferred solution. This was tried in this research with cost benefit analysis, but preferential independence between contractor cost and expected risk mitigation prohibited the use of an additive value function. Being able to optimize the decision eliminates the need to explain constructed units. The last idea for future research is to test and adapt the methodology to other FES flights or other first responder organizations.

Summary

FES flights are very diverse and very dynamic. There were few questions that were not answered with "it depends," making it very difficult to model. In addition to the modeling being difficult, the software used to calculate the decision tree was not robust enough for the size of the model. The software that was used only allowed up to 500 total nodes. The model was split to reduce the nodes and then exceeded the capacity of number of decision trees so all the formulas had to be hand entered into a spreadsheet. The software was used for the visuals, but the spreadsheet was used for the calculations. Using the spreadsheet for the calculations increased the speed of calculations and decreased the size on disk. The programs offer nice features, but size is something to think about before committing to a modeling program.

However, once the problem was able to be modeled, it performed great. The expected risk mitigation, the cost/benefit relationship and the 20% normal absences all pointed to a range of values between 55% and 65% manpower level. The sensitivity analysis revealed that the expected risk mitigation value was very sensitive to the manpower risk factors. The model worked well and the results were clear and easy to understand.

Appendix A: Categorized ACES-FD Response Data (1 Jan 2004 to 25 Jan 2007)

Structural Response	# of Responses	Response Cost ($)
Yes Secondary Category		
Conventional		
ELECTRICAL PROBLEM, BLDG	4	173.00
FA CODE (40% Yes Alarm)	258	11,716.74
REPORTED FIRE, DUMPSTER	3	262.19
REPORTED FIRE, FACILITY	3	131.11
REPORTED FIRE, UNCL/MUNIT	2	935.20
REPORTED SMOKE, FACILITY	8	438.08
REPORTED SMOKE, UNCLASS	15	1,961.72
STRUCTURAL, UNCLASS	29	1,331.79
ODOR INVESTIGATION, ELEC	2	85.72
ODOR INVESTIGATION, GAS LPG	84	3,441.59
ODOR INVESTIGATION, SMOKE	12	402.98
ODOR INVSTGN, UNCLASS, STRU	9	298.68
RESCUE PERSON ELEVATOR	9	170.74
Unconventional		
MUTUAL AID GRASS FIRE	3	1,240.19
POWER LINE DOWN	11	418.19
REPORTED, FIRE GRASS	22	1,787.88
Totals Structural (Yes)	**474**	**24,795.80**
Average Structural (Yes) Cost		**52.31**
False Secondary Category		
ACCIDENTAL ALARM ACTIVATION	2	57.81
ALMS DUE TO SEVERE WEATHER	2	35.55
BELLS GOING OFF	14	282.30
BOMB THREAT, STRUCTURE	5	2,181.78
FA CODE (60% False Alarm)	387	17,575.12
FIRE SYSTEM ACTIVATED	63	1,863.84
FIRE SYSTEM ASSISTANCE	3	92.14
FIRE SYSTEM PROBLEM, UNCLA	11	207.68
STRUCTURE, CO CALL	1	35.20
SVA OR ZID TROUBLE	2	28.80
Totals Structural (False)	**490**	**22,360.22**
Average Structural (False) Cost		**45.63**

(Jones, 2007, Brown, 2007)

Aircraft Response	# of Responses	Response Cost ($)
Yes Secondary Category		
Ground		
BLOWN TIRE, ACFT, GROUND	5	346.37
ELECT, PROB, ACFT, GROUND	4	327.63
ENGINE PROBLEMS, GROUND	4	227.01
FUEL PROBLEMS, GROUND	12	865.00
GEAR CNTL PROB, ACFT, GR	1	17.95
GROUND EMERG, UNCLASS	29	2,447.42
HOT BRAKES, GORUND	21	3,454.98
HYDRAULIC PROBLEMS, GROUN	2	135.00
REPORTED FIRE, ACFT, GRD	4	256.93
REPORTED SMOKE, ACFT, GRD	24	2,475.41
REPRTD FIRE ACFT IN HANGR	1	56.16
REPRTD SMOKE ACFT IN HANG	2	240.33
ODOR INVESTIGATION, ACFT	2	138.96
In-flight		
ODOR INVESTIGATION, ACFT	1	260.64
BIRD STRIKE, ACFT	14	1,118.91
BLOWN TIRE, ACFT	1	150.92
CRACKED WINDSHIELD, ACFT	2	137.36
DAMAGE ON ACFT	4	436.15
ELECTRICAL PROBLEMS, ACFT	21	2,145.17
ENGINE PROBLEMS, INFLIGHT	189	14,204.02
FLGHT CNTROL PROBLEM, ACFT	26	2,501.34
FUEL PROBLEMS, ACFT	11	567.44
GEAR CONTROL PROBLEM, ACFT	55	6,363.64
HUNG ORDINANCE, ACFT	38	7,022.80
HYDRAULIC PROBLEMS, ACFT	32	4,601.75
INFLIGHT EMERG, UNCLASS	54	5,506.71
REPORTED FIRE, ACFT	2	256.18
REPORTED SMOKE, ACFT	8	928.32
Totals Aircraft (Yes)	**569**	**57,190.50**
Average Aircraft (Yes) Cost		**100.51**
False Secondary Category		
Ground		
BOMB THREAT, ACFT, GROUND	1	24.00
Standby		
ACFT MAINTANCE, STANDBY	8	393.13
ASSAULT STANDBY (TYE LZ)	787	118,519.28
B-1 STAND-BY MAINTENANCE	3	58.08
ENGINE START, STANDBY	57	2,834.33
NAOC AIRCRAFT STANDBY	104	7,343.73
UPLOAD/DOWNLOAD, STANDBY	2	242.73
Totals Aircraft (False)	**962**	**129,415.28**
Average Aircraft (False) Cost		**134.53**

(Jones, 2007, Brown, 2007)

HAZMAT Response	# of Responses	Response Cost ($)
Yes Secondary Category		
Conventional		
BLOWING GAS LINE	2	69.93
CHEM SPILL, ACFT, CLASS 1	4	116.03
CHEM SPILL, BLDG, CLASS 1	1	30.50
CHEM SPILL, BLDG, CLASS 2	1	115.07
CHEM SPILL, UNCLASS	2	65.36
CHEM SPILL, VEHICLE CLS1	5	107.15
CHEM SPILL, VEHICLE CLS2	1	6.78
CHEM SPILL, W/VICTIMS	1	557.88
CHEMICAL SPILL INVESTIGATION	7	411.40
ODOR INVESTIGATION, GAS	12	416.47
LEAKING GAS LINE	5	288.05
MUTUAL AID CHEMICAL SPILL	1	828.22
FUEL SPILL, ACFT, CLASS 1	11	961.51
FUEL SPILL, ACFT, CLASS 2	12	1,063.91
FUEL SPILL, ACFT, CLASS 3	3	1,541.65
FUEL SPILL, BLDG, CLASS 2	1	146.96
FUEL SPILL, EQUIPMENT	3	49.55
FUEL SPILL, GOV, CLASS 1	5	87.98
FUEL SPILL, GOV CLASS 2	1	7.20
FUEL SPILL, POV	2	207.59
FUEL SPILL, UNCLASSIFIED	12	560.74
FUEL SPILL, INVESTIGATION	9	1,351.67
FUEL SPILL, STORAGE TK, CLS 1	5	216.65
FUEL SPILL, STORAGE TK, CLS 2	3	106.05
FUEL SPILL, POV	2	45.34
Totals HAZMAT (Yes)	**111**	**9,359.64**
Average HAZMAT (Yes) Cost		**84.32**
False Secondary Category		
HAZARDOUS CARGO	1	762.38
HAZARDOUS CONDITIONS, STBY	7	440.75
INITIAL FUEL/REFUEL	9	406.66
REFUEL WITH PASSENGERS	37	1,852.77
Totals HAZMAT (False)	**54**	**3,462.56**
Average HAZMAT (False) Cost		**64.12**

(Jones, 2007, Brown, 2007)

Other Response	# of Responses	Response Cost ($)
Yes Secondary Category		
Equipment		
ACCID EQUIP, NO INJURY	1	118.77
ELECT PROB, EQUIP	1	246.60
HYDRAUL PROB, EQUIP	2	97.80
REPORTED SMOKE, EQUIP	1	7.86
REPORTED SMOKE, EQUIP	1	7.86
Vehicle		
ACCID, POV W INJURIES	1	53.44
ACCIDENT, GOV NO INJURY	2	183.91
ACCIDENT, POV NO INJURY	7	467.81
REPORTED FIRE, GOV, NO INJURY	1	14.40
REPORTED FIRE, POV, NO INJURY	1	30.52
REPORTED SMOKE, GOV, NO INJ	1	16.70
REPORTED SMOKE, POV, NO INJ	1	14.47
VEHICLE INCIDENT INVESTIGATION	7	196.44
VEHICLE, UNCLASS	6	367.24
EMS		
ACCID, EQUIPMENT W/INJURY	1	77.40
ACCID, INDUSTRIAL, W/INJURY	1	35.15
MEDICAL EMERGENCY, CO CALL	7	411.85
MEDICAL EMERGENCY, UNCLASS	78	2,322.32
MEDICAL EMERGENCY	26	629.88
MINOR INJURY	23	528.24
PERSON DOWN	42	941.77
SEIZURES	7	182.54
Rescue		
ACCID, POV W INJURIES	1	12.91
MINOR INJURY	15	409.40
PERSON TRAPPED	2	69.01
RESCUE EMERG, UNCLASS	13	369.02
Totals Other (Yes)	**249**	**7,813.31**
Average Other (Yes) Cost		**31.38**
False Secondary Category		
Standby		
MEDI VAC	1	58.80
STANDBY, SPECIAL ASSIGNMENT	3	115.73
STANDBY, UNCLASS	22	1,242.76
Totals Other (False)	**26**	**1,417.29**
Average Other (False) Cost		**54.51**

(Jones, 2007, Brown, 2007)

Omitted	Number of Events	Event Cost ($)
Exercise		
EXERCISE STANDBY	4	11.08
EXERCISE, RESCUE	8	789.08
EXERCISE, INFLIGHT	18	2,282.12
EXERCISE, GROUND	54	4,118.30
EXERCISE MEDICAL	8	90.88
EXERCISE, VEHICLE	1	1.22
EXERCISE, STRUCTURAL	71	5,494.50
EXERCISE, UNCLASS	6	709.42
EXERCISE, HAZMAT	2	724.08
Omitted Totals	**172**	**14,220.68**

(Jones, 2007, Brown, 2007)

Appendix B: ACES-FD HAZMAT Response Data

2006 HAZMAT Response	Response Cost ($)
Yes Secondary Category	
Conventional	
BLOWING GAS LINE	1
CHEM SPILL, ACFT, CLASS 1	1
CHEM SPILL, BLDG, CLASS 1	1
CHEM SPILL, BLDG, CLASS 2	0
CHEM SPILL, UNCLASS	1
CHEM SPILL, VEHICLE CLS1	1
CHEM SPILL, VEHICLE CLS2	0
CHEM SPILL, W/VICTIMS	0
CHEMICAL SPILL INVESTIGATION	3
ODOR INVESTIGATION, GAS	10
LEAKING GAS LINE	3
MUTUAL AID CHEMICAL SPILL	0
FUEL SPILL, ACFT, CLASS 1	4
FUEL SPILL, ACFT, CLASS 2	4
FUEL SPILL, ACFT, CLASS 3	1
FUEL SPILL, BLDG, CLASS 2	0
FUEL SPILL, EQUIPMENT	1
FUEL SPILL, GOV, CLASS 1	1
FUEL SPILL, GOV CLASS 2	0
FUEL SPILL, POV	1
FUEL SPILL, UNCLASSIFIED	1
FUEL SPILL, INVESTIGATION	2
FUEL SPILL, STORAGE TK, CLS 1	2
FUEL SPILL, STORAGE TK, CLS 2	2
FUEL SPILL, POV	1
Totals HAZMAT (Yes)	**41**
False Secondary Category	
HAZARDOUS CARGO	
HAZARDOUS CONDITIONS, STBY	1
INITIAL FUEL/REFUEL	3
REFUEL WITH PASSENGERS	10
Totals HAZMAT (False)	**14**
Omitted	
EXERCISE, HAZMAT	1
Totals HAZMAT (Omitted)	**1**

(Jones, 2007, Brown, 2007)

Appendix C: 20 Percent Normal Absence Consequence Data

100% Manpower Level Consequence Data (20% NA)						
		Cost/Alarm ($)			Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost	
Aircraft	Yes	100.51	12,337.43	12,437.94	0.000657
	False	134.53	-	134.53	-
Structural	Yes	52.31	127.22	179.53	0.002889
	False	45.63	-	45.63	-
HAZMAT	Yes	84.32	27.01	111.34	0.000020
	False	64.12	-	64.12	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

90% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost	
Aircraft	Yes	100.51	12,337.43	12,437.94	0.000657
	False	134.53	-	134.53	-
Structural	Yes	52.31	127.22	179.53	0.002889
	False	45.63	-	45.63	-
HAZMAT	Yes	84.32	27.01	111.34	0.000020
	False	64.12	-	64.12	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

80% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost	
Aircraft	Yes	100.51	12,337.43	12,437.94	0.000657
	False	134.53	-	134.53	-
Structural	Yes	52.31	127.22	179.53	0.002889
	False	45.63	-	45.63	-
HAZMAT	Yes	84.32	27.01	111.34	0.000020
	False	64.12	-	64.12	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

70% Manpower Level Consequence Data (20% NA)						
		Cost/Alarm ($)				Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost		
Aircraft	Yes	100.51	12,337.43	12,437.94		0.000657
	False	134.53	-	134.53		-
Structural	Yes	52.31	127.22	179.53		0.002889
	False	45.63	-	45.63		-
HAZMAT	Yes	84.32	27.01	111.34		0.000020
	False	64.12	-	64.12		-
Other	Yes	31.38	0.30	31.68		0.000563
	False	54.51	-	54.51		-

60% Manpower Level Consequence Data (20% NA)						
		Cost/Alarm ($)				Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost		
Aircraft	Yes	100.51	12,337.43	12,437.94		0.000789
	False	134.53	-	134.53		-
Structural	Yes	52.31	127.22	179.53		0.002889
	False	45.63	-	45.63		-
HAZMAT	Yes	84.32	27.01	111.34		0.000020
	False	64.12	-	64.12		-
Other	Yes	31.38	0.30	31.68		0.000563
	False	54.51	-	54.51		-

50% Manpower Level Consequence Data (20% NA)						
		Cost/Alarm ($)				Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost		
Aircraft	Yes	120.61	14,804.92	14,925.53		0.000920
	False	161.43	-	161.43		-
Structural	Yes	52.31	127.22	179.53		0.002889
	False	45.63	-	45.63		-
HAZMAT	Yes	84.32	27.01	111.34		0.000020
	False	64.12	-	64.12		-
Other	Yes	31.38	0.30	31.68		0.000563
	False	54.51	-	54.51		-

40% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			
Category	Sub - Category	Response Cost	Material Cost	Total Cost	Loss Of Life per Alarm
Aircraft	Yes	140.71	17,272.41	17,413.12	0.001052
	False	188.34	-	188.34	-
Structural	Yes	57.54	139.94	197.48	0.003467
	False	50.20	-	50.20	-
HAZMAT	Yes	92.75	29.72	122.47	0.000028
	False	70.53	-	70.53	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

30% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			
Category	Sub - Category	Response Cost	Material Cost	Total Cost	Loss Of Life per Alarm
Aircraft	Yes	150.77	18,506.15	18,656.92	0.001118
	False	201.79	-	201.79	-
Structural	Yes	62.77	152.66	215.43	0.004045
	False	54.76	-	54.76	-
HAZMAT	Yes	109.62	35.12	144.74	0.000034
	False	83.36	-	83.36	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

20% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			
Category	Sub - Category	Response Cost	Material Cost	Total Cost	Loss Of Life per Alarm
Aircraft	Yes	170.87	20,973.64	21,144.51	0.001249
	False	228.70	-	228.70	-
Structural	Yes	78.47	190.82	269.29	0.005201
	False	68.45	-	68.45	-
HAZMAT	Yes	134.91	43.22	178.14	0.000040
	False	102.59	-	102.59	-
Other	Yes	31.38	0.30	31.68	0.000563
	False	54.51	-	54.51	-

10% Manpower Level Consequence Data (20% NA)					
		Cost/Alarm ($)			Loss Of Life per Alarm
Category	Sub - Category	Response Cost	Material Cost	Total Cost	
Aircraft	Yes	201.02	24,674.87	24,875.89	0.001315
	False	269.05	-	269.05	-
Structural	Yes	104.62	254.43	359.05	0.005779
	False	91.27	-	91.27	-
HAZMAT	Yes	168.64	54.03	222.67	0.000040
	False	128.24	-	128.24	-
Other	Yes	62.76	0.60	63.36	0.001126
	False	109.02	-	109.02	-

Appendix D: 20 Percent Normal Single Consequence [$v(X_C)$] Data

Risk Scenarios for 10% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	26,118.56	0.0326	0.0083	0.0823	0.0823	0.0699	0.0575	0.0451	0.0326
1	1	1	1	1	1	1	0	26,009.54	0.0367	0.0083	0.0823	0.0823	0.0709	0.0595	0.0481	0.0367
1	1	1	1	1	1	0	1	26,055.20	0.0350	0.0071	0.2074	0.2074	0.1643	0.1212	0.0781	0.0350
1	1	1	1	1	1	0	0	25,946.18	0.0390	0.0071	0.2074	0.2074	0.1653	0.1232	0.0811	0.0390
1	1	1	1	1	0	1	1	25,990.32	0.0374	0.0083	0.0823	0.0823	0.0711	0.0598	0.0486	0.0374
1	1	1	1	1	0	1	0	25,881.30	0.0414	0.0083	0.0823	0.0823	0.0721	0.0619	0.0516	0.0414
1	1	1	1	1	0	0	1	25,926.96	0.0397	0.0071	0.2074	0.2074	0.1655	0.1236	0.0817	0.0397
1	1	1	1	1	0	0	0	25,817.94	0.0438	0.0071	0.2074	0.2074	0.1665	0.1256	0.0847	0.0438
1	1	1	1	0	1	1	1	25,895.89	0.0409	0.0082	0.0867	0.0867	0.0753	0.0638	0.0523	0.0409
1	1	1	1	0	1	1	0	25,786.87	0.0449	0.0082	0.0867	0.0867	0.0763	0.0658	0.0554	0.0449
1	1	1	1	0	1	0	1	25,832.53	0.0432	0.0071	0.2118	0.2118	0.1697	0.1275	0.0854	0.0432
1	1	1	1	0	1	0	0	25,723.51	0.0473	0.0071	0.2118	0.2118	0.1707	0.1296	0.0884	0.0473
1	1	1	1	0	0	1	1	25,767.65	0.0456	0.0082	0.0867	0.0867	0.0764	0.0662	0.0559	0.0456
1	1	1	1	0	0	1	0	25,658.62	0.0497	0.0082	0.0867	0.0867	0.0775	0.0682	0.0589	0.0497
1	1	1	1	0	0	0	1	25,704.29	0.0480	0.0071	0.2118	0.2118	0.1709	0.1299	0.0890	0.0480
1	1	1	1	0	0	0	0	25,595.26	0.0520	0.0071	0.2118	0.2118	0.1719	0.1319	0.0920	0.0520
1	1	1	0	1	1	1	1	26,027.29	0.0360	0.0083	0.0823	0.0823	0.0707	0.0592	0.0476	0.0360
1	1	1	0	1	1	1	0	25,918.27	0.0401	0.0083	0.0823	0.0823	0.0717	0.0612	0.0506	0.0401
1	1	1	0	1	1	0	1	25,963.93	0.0384	0.0071	0.2074	0.2074	0.1651	0.1229	0.0806	0.0384
1	1	1	0	1	1	0	0	25,854.91	0.0424	0.0071	0.2074	0.2074	0.1662	0.1249	0.0837	0.0424
1	1	1	0	1	0	1	1	25,899.05	0.0408	0.0083	0.0823	0.0823	0.0719	0.0615	0.0512	0.0408
1	1	1	0	1	0	1	0	25,790.03	0.0448	0.0083	0.0823	0.0823	0.0729	0.0635	0.0542	0.0448
1	1	1	0	1	0	0	1	25,835.69	0.0431	0.0071	0.2074	0.2074	0.1663	0.1253	0.0842	0.0431
1	1	1	0	1	0	0	0	25,726.67	0.0472	0.0071	0.2074	0.2074	0.1673	0.1273	0.0872	0.0472
1	1	1	0	0	1	1	1	25,804.62	0.0443	0.0082	0.0867	0.0867	0.0761	0.0655	0.0549	0.0443
1	1	1	0	0	1	1	0	25,695.60	0.0483	0.0082	0.0867	0.0867	0.0771	0.0675	0.0579	0.0483
1	1	1	0	0	1	0	1	25,741.26	0.0466	0.0071	0.2118	0.2118	0.1705	0.1292	0.0879	0.0466
1	1	1	0	0	1	0	0	25,632.24	0.0507	0.0071	0.2118	0.2118	0.1715	0.1312	0.0910	0.0507
1	1	1	0	0	0	1	1	25,676.38	0.0490	0.0082	0.0867	0.0867	0.0773	0.0679	0.0584	0.0490
1	1	1	0	0	0	1	0	25,567.36	0.0531	0.0082	0.0867	0.0867	0.0783	0.0699	0.0615	0.0531
1	1	1	0	0	0	0	1	25,613.02	0.0514	0.0071	0.2118	0.2118	0.1717	0.1316	0.0915	0.0514
1	1	1	0	0	0	0	0	25,504.00	0.0554	0.0071	0.2118	0.2118	0.1727	0.1336	0.0945	0.0554
1	1	0	1	1	1	1	1	25,759.51	0.0459	0.0025	0.7244	0.7244	0.5548	0.3852	0.2155	0.0459
1	1	0	1	1	1	1	0	25,650.48	0.0500	0.0025	0.7244	0.7244	0.5558	0.3872	0.2186	0.0500
1	1	0	1	1	1	0	1	25,696.15	0.0483	0.0014	0.8495	0.8495	0.6492	0.4489	0.2486	0.0483
1	1	0	1	1	1	0	0	25,587.12	0.0523	0.0014	0.8495	0.8495	0.6502	0.4509	0.2516	0.0523
1	1	0	1	1	0	1	1	25,631.26	0.0507	0.0025	0.7244	0.7244	0.5559	0.3875	0.2191	0.0507
1	1	0	1	1	0	1	0	25,522.24	0.0547	0.0025	0.7244	0.7244	0.5570	0.3895	0.2221	0.0547
1	1	0	1	1	0	0	1	25,567.90	0.0530	0.0014	0.8495	0.8495	0.6504	0.4513	0.2522	0.0530
1	1	0	1	1	0	0	0	25,458.88	0.0571	0.0014	0.8495	0.8495	0.6514	0.4533	0.2552	0.0571
1	1	0	1	0	1	1	1	25,536.84	0.0542	0.0024	0.7288	0.7288	0.5601	0.3915	0.2228	0.0542
1	1	0	1	0	1	1	0	25,427.81	0.0582	0.0024	0.7288	0.7288	0.5612	0.3935	0.2259	0.0582
1	1	0	1	0	1	0	1	25,473.48	0.0565	0.0013	0.8539	0.8539	0.6546	0.4552	0.2559	0.0565
1	1	0	1	0	1	0	0	25,364.45	0.0606	0.0013	0.8539	0.8539	0.6556	0.4572	0.2589	0.0606
1	1	0	1	0	0	1	1	25,408.59	0.0589	0.0024	0.7288	0.7288	0.5613	0.3939	0.2264	0.0589
1	1	0	1	0	0	1	0	25,299.57	0.0630	0.0024	0.7288	0.7288	0.5623	0.3959	0.2294	0.0630
1	1	0	1	0	0	0	1	25,345.23	0.0613	0.0013	0.8539	0.8539	0.6558	0.4576	0.2594	0.0613
1	1	0	1	0	0	0	0	25,236.21	0.0653	0.0013	0.8539	0.8539	0.6568	0.4596	0.2625	0.0653
1	1	0	0	1	1	1	1	25,668.24	0.0493	0.0025	0.7244	0.7244	0.5556	0.3868	0.2181	0.0493
1	1	0	0	1	1	1	0	25,559.22	0.0534	0.0025	0.7244	0.7244	0.5566	0.3889	0.2211	0.0534
1	1	0	0	1	1	0	1	25,604.88	0.0517	0.0014	0.8495	0.8495	0.6500	0.4506	0.2511	0.0517
1	1	0	0	1	1	0	0	25,495.86	0.0557	0.0014	0.8495	0.8495	0.6510	0.4526	0.2542	0.0557
1	1	0	0	1	0	1	1	25,540.00	0.0541	0.0025	0.7244	0.7244	0.5568	0.3892	0.2216	0.0541
1	1	0	0	1	0	1	0	25,430.98	0.0581	0.0025	0.7244	0.7244	0.5578	0.3912	0.2247	0.0581
1	1	0	0	1	0	0	1	25,476.64	0.0564	0.0014	0.8495	0.8495	0.6512	0.4530	0.2547	0.0564
1	1	0	0	1	0	0	0	25,367.62	0.0605	0.0014	0.8495	0.8495	0.6522	0.4550	0.2577	0.0605
1	1	0	0	0	1	1	1	25,445.57	0.0576	0.0024	0.7288	0.7288	0.5610	0.3932	0.2254	0.0576
1	1	0	0	0	1	1	0	25,336.55	0.0616	0.0024	0.7288	0.7288	0.5620	0.3952	0.2284	0.0616
1	1	0	0	0	1	0	1	25,382.21	0.0599	0.0013	0.8539	0.8539	0.6554	0.4569	0.2584	0.0599
1	1	0	0	0	1	0	0	25,273.19	0.0640	0.0013	0.8539	0.8539	0.6564	0.4589	0.2614	0.0640
1	1	0	0	0	0	1	1	25,317.33	0.0623	0.0024	0.7288	0.7288	0.5622	0.3956	0.2289	0.0623
1	1	0	0	0	0	1	0	25,208.30	0.0664	0.0024	0.7288	0.7288	0.5632	0.3976	0.2320	0.0664
1	1	0	0	0	0	0	1	25,253.97	0.0647	0.0013	0.8539	0.8539	0.6566	0.4593	0.2620	0.0647
1	1	0	0	0	0	0	0	25,144.94	0.0687	0.0013	0.8539	0.8539	0.6576	0.4613	0.2650	0.0687

Risk Scenarios for 10% ML (1 ="Occur"; 0 ="No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	25,849.51	0.04261	0.00826	0.08228	0.0823	0.0724	0.0624	0.0525	0.0426
1	0	1	1	1	1	1	0	25,740.48	0.04665	0.00826	0.08228	0.0823	0.0734	0.0645	0.0556	0.0466
1	0	1	1	1	1	0	1	25,786.15	0.04496	0.00713	0.20740	0.2074	0.1668	0.1262	0.0856	0.0450
1	0	1	1	1	1	0	0	25,677.12	0.04900	0.00713	0.20740	0.2074	0.1678	0.1282	0.0886	0.0490
1	0	1	1	1	0	1	1	25,721.26	0.04736	0.00826	0.08228	0.0823	0.0735	0.0648	0.0561	0.0474
1	0	1	1	1	0	1	0	25,612.24	0.05140	0.00826	0.08228	0.0823	0.0746	0.0668	0.0591	0.0514
1	0	1	1	1	0	0	1	25,657.90	0.04971	0.00713	0.20740	0.2074	0.1680	0.1286	0.0891	0.0497
1	0	1	1	1	0	0	0	25,548.88	0.05375	0.00713	0.20740	0.2074	0.1690	0.1306	0.0922	0.0537
1	0	1	1	0	1	1	1	25,626.83	0.05086	0.00822	0.08671	0.0867	0.0777	0.0688	0.0598	0.0509
1	0	1	1	0	1	1	0	25,517.81	0.05490	0.00822	0.08671	0.0867	0.0788	0.0708	0.0629	0.0549
1	0	1	1	0	1	0	1	25,563.47	0.05320	0.00709	0.21183	0.2118	0.1722	0.1325	0.0929	0.0532
1	0	1	1	0	1	0	0	25,454.45	0.05724	0.00709	0.21183	0.2118	0.1732	0.1345	0.0959	0.0572
1	0	1	1	0	0	1	1	25,498.59	0.05561	0.00822	0.08671	0.0867	0.0789	0.0712	0.0634	0.0556
1	0	1	1	0	0	1	0	25,389.57	0.05965	0.00822	0.08671	0.0867	0.0799	0.0732	0.0664	0.0596
1	0	1	1	0	0	0	1	25,435.23	0.05795	0.00709	0.21183	0.2118	0.1734	0.1349	0.0964	0.0580
1	0	1	1	0	0	0	0	25,326.21	0.06199	0.00709	0.21183	0.2118	0.1744	0.1369	0.0995	0.0620
1	0	1	0	1	1	1	1	25,758.24	0.04599	0.00826	0.08228	0.0823	0.0732	0.0641	0.0551	0.0460
1	0	1	0	1	1	1	0	25,649.22	0.05003	0.00826	0.08228	0.0823	0.0742	0.0662	0.0581	0.0500
1	0	1	0	1	1	0	1	25,694.88	0.04834	0.00713	0.20740	0.2074	0.1676	0.1279	0.0881	0.0483
1	0	1	0	1	1	0	0	25,585.86	0.05238	0.00713	0.20740	0.2074	0.1686	0.1299	0.0911	0.0524
1	0	1	0	1	0	1	1	25,630.00	0.05074	0.00826	0.08228	0.0823	0.0744	0.0665	0.0586	0.0507
1	0	1	0	1	0	1	0	25,520.97	0.05478	0.00826	0.08228	0.0823	0.0754	0.0685	0.0617	0.0548
1	0	1	0	1	0	0	1	25,566.64	0.05309	0.00713	0.20740	0.2074	0.1688	0.1302	0.0917	0.0531
1	0	1	0	1	0	0	0	25,457.61	0.05713	0.00713	0.20740	0.2074	0.1698	0.1323	0.0947	0.0571
1	0	1	0	0	1	1	1	25,535.57	0.05424	0.00822	0.08671	0.0867	0.0786	0.0705	0.0624	0.0542
1	0	1	0	0	1	1	0	25,426.55	0.05828	0.00822	0.08671	0.0867	0.0796	0.0725	0.0654	0.0583
1	0	1	0	0	1	0	1	25,472.21	0.05658	0.00709	0.21183	0.2118	0.1730	0.1342	0.0954	0.0566
1	0	1	0	0	1	0	0	25,363.19	0.06062	0.00709	0.21183	0.2118	0.1740	0.1362	0.0984	0.0606
1	0	1	0	0	0	1	1	25,407.33	0.05899	0.00822	0.08671	0.0867	0.0798	0.0729	0.0659	0.0590
1	0	1	0	0	0	1	0	25,298.30	0.06303	0.00822	0.08671	0.0867	0.0808	0.0749	0.0689	0.0630
1	0	1	0	0	0	0	1	25,343.97	0.06133	0.00709	0.21183	0.2118	0.1742	0.1366	0.0990	0.0613
1	0	1	0	0	0	0	0	25,234.94	0.06537	0.00709	0.21183	0.2118	0.1752	0.1386	0.1020	0.0654
1	0	0	1	1	1	1	1	25,490.45	0.05591	0.00248	0.72436	0.7244	0.5573	0.3901	0.2230	0.0559
1	0	0	1	1	1	1	0	25,381.43	0.05995	0.00248	0.72436	0.7244	0.5583	0.3922	0.2261	0.0599
1	0	0	1	1	1	0	1	25,427.09	0.05826	0.00135	0.84948	0.8495	0.6517	0.4539	0.2561	0.0583
1	0	0	1	1	1	0	0	25,318.07	0.06229	0.00135	0.84948	0.8495	0.6527	0.4559	0.2591	0.0623
1	0	0	1	1	0	1	1	25,362.21	0.06066	0.00248	0.72436	0.7244	0.5584	0.3925	0.2266	0.0607
1	0	0	1	1	0	1	0	25,253.19	0.06470	0.00248	0.72436	0.7244	0.5594	0.3945	0.2296	0.0647
1	0	0	1	1	0	0	1	25,298.85	0.06301	0.00135	0.84948	0.8495	0.6529	0.4562	0.2596	0.0630
1	0	0	1	1	0	0	0	25,189.83	0.06704	0.00135	0.84948	0.8495	0.6539	0.4583	0.2627	0.0670
1	0	0	1	0	1	1	1	25,267.78	0.06416	0.00244	0.72880	0.7288	0.5626	0.3965	0.2303	0.0642
1	0	0	1	0	1	1	0	25,158.76	0.06819	0.00244	0.72880	0.7288	0.5636	0.3985	0.2333	0.0682
1	0	0	1	0	1	0	1	25,204.42	0.06650	0.00131	0.85392	0.8539	0.6571	0.4602	0.2634	0.0665
1	0	0	1	0	1	0	0	25,095.40	0.07054	0.00131	0.85392	0.8539	0.6581	0.4622	0.2664	0.0705
1	0	0	1	0	0	1	1	25,139.54	0.06891	0.00244	0.72880	0.7288	0.5638	0.3989	0.2339	0.0689
1	0	0	1	0	0	1	0	25,030.52	0.07294	0.00244	0.72880	0.7288	0.5648	0.4009	0.2369	0.0729
1	0	0	1	0	0	0	1	25,076.18	0.07125	0.00131	0.85392	0.8539	0.6583	0.4626	0.2669	0.0713
1	0	0	1	0	0	0	0	24,967.16	0.07529	0.00131	0.85392	0.8539	0.6593	0.4646	0.2699	0.0753
1	0	0	0	1	1	1	1	25,399.19	0.05929	0.00248	0.72436	0.7244	0.5581	0.3918	0.2256	0.0593
1	0	0	0	1	1	1	0	25,290.16	0.06333	0.00248	0.72436	0.7244	0.5591	0.3938	0.2286	0.0633
1	0	0	0	1	1	0	1	25,335.83	0.06164	0.00135	0.84948	0.8495	0.6525	0.4556	0.2586	0.0616
1	0	0	0	1	1	0	0	25,226.80	0.06567	0.00135	0.84948	0.8495	0.6535	0.4576	0.2616	0.0657
1	0	0	0	1	0	1	1	25,270.94	0.06404	0.00248	0.72436	0.7244	0.5593	0.3942	0.2291	0.0640
1	0	0	0	1	0	1	0	25,161.92	0.06808	0.00248	0.72436	0.7244	0.5603	0.3962	0.2321	0.0681
1	0	0	0	1	0	0	1	25,207.58	0.06639	0.00135	0.84948	0.8495	0.6537	0.4579	0.2622	0.0664
1	0	0	0	1	0	0	0	25,098.56	0.07042	0.00135	0.84948	0.8495	0.6547	0.4600	0.2652	0.0704
1	0	0	0	0	1	1	1	25,176.51	0.06754	0.00244	0.72880	0.7288	0.5635	0.3982	0.2329	0.0675
1	0	0	0	0	1	1	0	25,067.49	0.07157	0.00244	0.72880	0.7288	0.5645	0.4002	0.2359	0.0716
1	0	0	0	0	1	0	1	25,113.15	0.06988	0.00131	0.85392	0.8539	0.6579	0.4619	0.2659	0.0699
1	0	0	0	0	1	0	0	25,004.13	0.07392	0.00131	0.85392	0.8539	0.6589	0.4639	0.2689	0.0739
1	0	0	0	0	0	1	1	25,048.27	0.07229	0.00244	0.72880	0.7288	0.5647	0.4005	0.2364	0.0723
1	0	0	0	0	0	1	0	24,939.25	0.07632	0.00244	0.72880	0.7288	0.5657	0.4026	0.2394	0.0763
1	0	0	0	0	0	0	1	24,984.91	0.07463	0.00131	0.85392	0.8539	0.6591	0.4643	0.2695	0.0746
1	0	0	0	0	0	0	0	24,875.89	0.07867	0.00131	0.85392	0.8539	0.6601	0.4663	0.2725	0.0787

Risk Scenarios for 10% ML (1 = "Occur"; 0 = "No")								Single Consequence Data				w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other											
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	
0	1	1	1	1	1	1	1	1,242.67	0.95398	0.00694	0.22836	0.2284	0.4098	0.5912	0.7726	0.9540	
0	1	1	1	1	1	1	0	1,133.65	0.95801	0.00694	0.22836	0.2284	0.4108	0.5932	0.7756	0.9580	
0	1	1	1	1	1	0	1	1,179.31	0.95632	0.00582	0.35348	0.3535	0.5042	0.6549	0.8056	0.9563	
0	1	1	1	1	1	0	0	1,070.29	0.96036	0.00582	0.35348	0.3535	0.5052	0.6569	0.8086	0.9604	
0	1	1	1	1	0	1	1	1,114.43	0.95872	0.00694	0.22836	0.2284	0.4109	0.5935	0.7761	0.9587	
0	1	1	1	1	0	1	0	1,005.41	0.96276	0.00694	0.22836	0.2284	0.4120	0.5956	0.7792	0.9628	
0	1	1	1	1	0	0	1	1,051.07	0.96107	0.00582	0.35348	0.3535	0.5054	0.6573	0.8092	0.9611	
0	1	1	1	1	0	0	0	942.05	0.96511	0.00582	0.35348	0.3535	0.5064	0.6593	0.8122	0.9651	
0	1	1	1	0	1	1	1	1,020.00	0.96222	0.00690	0.23279	0.2328	0.4152	0.5975	0.7799	0.9622	
0	1	1	1	0	1	1	0	910.98	0.96626	0.00690	0.23279	0.2328	0.4162	0.5995	0.7829	0.9663	
0	1	1	1	0	1	0	1	956.64	0.96457	0.00578	0.35791	0.3579	0.5096	0.6612	0.8129	0.9646	
0	1	1	1	0	1	0	0	847.62	0.96861	0.00578	0.35791	0.3579	0.5106	0.6633	0.8159	0.9686	
0	1	1	1	0	0	1	1	891.76	0.96697	0.00690	0.23279	0.2328	0.4163	0.5999	0.7834	0.9670	
0	1	1	1	0	0	1	0	782.73	0.97101	0.00690	0.23279	0.2328	0.4173	0.6019	0.7865	0.9710	
0	1	1	1	0	0	0	1	828.40	0.96932	0.00578	0.35791	0.3579	0.5108	0.6636	0.8165	0.9693	
0	1	1	1	0	0	0	0	719.37	0.97336	0.00578	0.35791	0.3579	0.5118	0.6656	0.8195	0.9734	
0	1	1	0	1	1	1	1	1,151.41	0.95736	0.00694	0.22836	0.2284	0.4106	0.5929	0.7751	0.9574	
0	1	1	0	1	1	1	0	1,042.38	0.96139	0.00694	0.22836	0.2284	0.4116	0.5949	0.7781	0.9614	
0	1	1	0	1	1	0	1	1,088.05	0.95970	0.00582	0.35348	0.3535	0.5050	0.6566	0.8081	0.9597	
0	1	1	0	1	1	0	0	979.02	0.96374	0.00582	0.35348	0.3535	0.5060	0.6586	0.8112	0.9637	
0	1	1	0	1	0	1	1	1,023.16	0.96211	0.00694	0.22836	0.2284	0.4118	0.5952	0.7787	0.9621	
0	1	1	0	1	0	1	0	914.14	0.96614	0.00694	0.22836	0.2284	0.4128	0.5973	0.7817	0.9661	
0	1	1	0	1	0	0	1	959.80	0.96445	0.00582	0.35348	0.3535	0.5062	0.6590	0.8117	0.9645	
0	1	1	0	1	0	0	0	850.78	0.96849	0.00582	0.35348	0.3535	0.5072	0.6610	0.8147	0.9685	
0	1	1	0	0	1	1	1	928.73	0.96560	0.00690	0.23279	0.2328	0.4160	0.5992	0.7824	0.9656	
0	1	1	0	0	1	1	0	819.71	0.96964	0.00690	0.23279	0.2328	0.4170	0.6012	0.7854	0.9696	
0	1	1	0	0	1	0	1	865.37	0.96795	0.00578	0.35791	0.3579	0.5104	0.6629	0.8154	0.9679	
0	1	1	0	0	1	0	0	756.35	0.97199	0.00578	0.35791	0.3579	0.5114	0.6650	0.8185	0.9720	
0	1	1	0	0	0	1	1	800.49	0.97035	0.00690	0.23279	0.2328	0.4172	0.6016	0.7860	0.9704	
0	1	1	0	0	0	1	0	691.47	0.97439	0.00690	0.23279	0.2328	0.4182	0.6036	0.7890	0.9744	
0	1	1	0	0	0	0	1	737.13	0.97270	0.00578	0.35791	0.3579	0.5116	0.6653	0.8190	0.9727	
0	1	1	0	0	0	0	0	628.11	0.97674	0.00578	0.35791	0.3579	0.5126	0.6673	0.8220	0.9767	
0	1	0	1	1	1	1	1	883.62	0.96727	0.00117	0.87044	0.8704	0.8947	0.9189	0.9431	0.9673	
0	1	0	1	1	1	1	0	774.60	0.97131	0.00117	0.87044	0.8704	0.8957	0.9209	0.9461	0.9713	
0	1	0	1	1	1	0	1	820.26	0.96962	0.00004	0.99556	0.9956	0.9891	0.9826	0.9761	0.9696	
0	1	0	1	1	1	0	0	711.24	0.97366	0.00004	0.99556	0.9956	0.9901	0.9846	0.9791	0.9737	
0	1	0	1	1	0	1	1	755.37	0.97202	0.00117	0.87044	0.8704	0.8958	0.9212	0.9466	0.9720	
0	1	0	1	1	0	1	0	646.35	0.97606	0.00117	0.87044	0.8704	0.8968	0.9233	0.9497	0.9761	
0	1	0	1	1	0	0	1	692.01	0.97437	0.00004	0.99556	0.9956	0.9903	0.9850	0.9797	0.9744	
0	1	0	1	1	0	0	0	582.99	0.97841	0.00004	0.99556	0.9956	0.9913	0.9870	0.9827	0.9784	
0	1	0	1	0	1	1	1	660.95	0.97552	0.00113	0.87488	0.8749	0.9000	0.9252	0.9504	0.9755	
0	1	0	1	0	1	1	0	551.92	0.97956	0.00113	0.87488	0.8749	0.9010	0.9272	0.9534	0.9796	
0	1	0	1	0	1	0	1	597.59	0.97787	0.00000	1.00000	1.0000	0.9945	0.9889	0.9834	0.9779	
0	1	0	1	0	1	0	0	488.56	0.98191	0.00000	1.00000	1.0000	0.9955	0.9910	0.9864	0.9819	
0	1	0	1	0	0	1	1	532.70	0.98027	0.00113	0.87488	0.8749	0.9012	0.9276	0.9539	0.9803	
0	1	0	1	0	0	1	0	423.68	0.98431	0.00113	0.87488	0.8749	0.9022	0.9296	0.9570	0.9843	
0	1	0	1	0	0	0	1	469.34	0.98262	0.00000	1.00000	1.0000	0.9957	0.9913	0.9870	0.9826	
0	1	0	1	0	0	0	0	360.32	0.98665	0.00000	1.00000	1.0000	0.9967	0.9933	0.9900	0.9867	
0	1	0	0	1	1	1	1	792.35	0.97065	0.00117	0.87044	0.8704	0.8955	0.9205	0.9456	0.9707	
0	1	0	0	1	1	1	0	683.33	0.97469	0.00117	0.87044	0.8704	0.8965	0.9226	0.9486	0.9747	
0	1	0	0	1	1	0	1	728.99	0.97300	0.00004	0.99556	0.9956	0.9899	0.9843	0.9786	0.9730	
0	1	0	0	1	1	0	0	619.97	0.97704	0.00004	0.99556	0.9956	0.9909	0.9863	0.9817	0.9770	
0	1	0	0	1	0	1	1	664.11	0.97540	0.00117	0.87044	0.8704	0.8967	0.9229	0.9492	0.9754	
0	1	0	0	1	0	1	0	555.09	0.97944	0.00117	0.87044	0.8704	0.8977	0.9249	0.9522	0.9794	
0	1	0	0	1	0	0	1	600.75	0.97775	0.00004	0.99556	0.9956	0.9911	0.9867	0.9822	0.9778	
0	1	0	0	1	0	0	0	491.73	0.98179	0.00004	0.99556	0.9956	0.9921	0.9887	0.9852	0.9818	
0	1	0	0	0	1	1	1	569.68	0.97890	0.00113	0.87488	0.8749	0.9009	0.9269	0.9529	0.9789	
0	1	0	0	0	1	1	0	460.66	0.98294	0.00113	0.87488	0.8749	0.9019	0.9289	0.9559	0.9829	
0	1	0	0	0	1	0	1	506.32	0.98125	0.00000	1.00000	1.0000	0.9953	0.9906	0.9859	0.9812	
0	1	0	0	0	1	0	0	397.30	0.98529	0.00000	1.00000	1.0000	0.9963	0.9926	0.9890	0.9853	
0	1	0	0	0	0	1	1	441.44	0.98365	0.00113	0.87488	0.8749	0.9021	0.9293	0.9565	0.9837	
0	1	0	0	0	0	1	0	332.41	0.98769	0.00113	0.87488	0.8749	0.9031	0.9313	0.9595	0.9877	
0	1	0	0	0	0	0	1	378.08	0.98600	0.00000	1.00000	1.0000	0.9965	0.9930	0.9895	0.9860	
0	1	0	0	0	0	0	0	269.05	0.99004	0.00000	1.00000	1.0000	0.9975	0.9950	0.9925	0.9900	

Risk Scenarios for 10% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	973.62	0.96394	0.00694	0.22836	0.2284	0.4123	0.5961	0.7800	0.9639
0	0	1	1	1	1	1	0	864.59	0.96798	0.00694	0.22836	0.2284	0.4133	0.5982	0.7831	0.9680
0	0	1	1	1	1	0	1	910.26	0.96629	0.00582	0.35348	0.3535	0.5067	0.6599	0.8131	0.9663
0	0	1	1	1	1	0	0	801.23	0.97032	0.00582	0.35348	0.3535	0.5077	0.6619	0.8161	0.9703
0	0	1	1	1	0	1	1	845.37	0.96869	0.00694	0.22836	0.2284	0.4134	0.5985	0.7836	0.9687
0	0	1	1	1	0	1	0	736.35	0.97273	0.00694	0.22836	0.2284	0.4145	0.6005	0.7866	0.9727
0	0	1	1	1	0	0	1	782.01	0.97104	0.00582	0.35348	0.3535	0.5079	0.6623	0.8166	0.9710
0	0	1	1	1	0	0	0	672.99	0.97507	0.00582	0.35348	0.3535	0.5089	0.6643	0.8197	0.9751
0	0	1	1	0	1	1	1	750.95	0.97219	0.00690	0.23279	0.2328	0.4176	0.6025	0.7873	0.9722
0	0	1	1	0	1	1	0	641.92	0.97623	0.00690	0.23279	0.2328	0.4187	0.6045	0.7904	0.9762
0	0	1	1	0	1	0	1	687.59	0.97453	0.00578	0.35791	0.3579	0.5121	0.6662	0.8204	0.9745
0	0	1	1	0	1	0	0	578.56	0.97857	0.00578	0.35791	0.3579	0.5131	0.6682	0.8234	0.9786
0	0	1	1	0	0	1	1	622.70	0.97694	0.00690	0.23279	0.2328	0.4188	0.6049	0.7909	0.9769
0	0	1	1	0	0	1	0	513.68	0.98097	0.00690	0.23279	0.2328	0.4198	0.6069	0.7939	0.9810
0	0	1	1	0	0	0	1	559.34	0.97928	0.00578	0.35791	0.3579	0.5133	0.6686	0.8239	0.9793
0	0	1	1	0	0	0	0	450.32	0.98332	0.00578	0.35791	0.3579	0.5143	0.6706	0.8270	0.9833
0	0	1	0	1	1	1	1	882.35	0.96732	0.00694	0.22836	0.2284	0.4131	0.5978	0.7826	0.9673
0	0	1	0	1	1	1	0	773.33	0.97136	0.00694	0.22836	0.2284	0.4141	0.5999	0.7856	0.9714
0	0	1	0	1	1	0	1	818.99	0.96967	0.00582	0.35348	0.3535	0.5075	0.6616	0.8156	0.9697
0	0	1	0	1	1	0	0	709.97	0.97370	0.00582	0.35348	0.3535	0.5085	0.6636	0.8186	0.9737
0	0	1	0	1	0	1	1	754.11	0.97207	0.00694	0.22836	0.2284	0.4143	0.6002	0.7861	0.9721
0	0	1	0	1	0	1	0	645.09	0.97611	0.00694	0.22836	0.2284	0.4153	0.6022	0.7892	0.9761
0	0	1	0	1	0	0	1	690.75	0.97442	0.00582	0.35348	0.3535	0.5087	0.6639	0.8192	0.9744
0	0	1	0	1	0	0	0	581.73	0.97845	0.00582	0.35348	0.3535	0.5097	0.6660	0.8222	0.9785
0	0	1	0	0	1	1	1	659.68	0.97557	0.00690	0.23279	0.2328	0.4185	0.6042	0.7899	0.9756
0	0	1	0	0	1	1	0	550.66	0.97961	0.00690	0.23279	0.2328	0.4195	0.6062	0.7929	0.9796
0	0	1	0	0	1	0	1	596.32	0.97791	0.00578	0.35791	0.3579	0.5129	0.6679	0.8229	0.9779
0	0	1	0	0	1	0	0	487.30	0.98195	0.00578	0.35791	0.3579	0.5139	0.6699	0.8259	0.9820
0	0	1	0	0	0	1	1	531.44	0.98032	0.00690	0.23279	0.2328	0.4197	0.6066	0.7934	0.9803
0	0	1	0	0	0	1	0	422.41	0.98436	0.00690	0.23279	0.2328	0.4207	0.6086	0.7965	0.9844
0	0	1	0	0	0	0	1	468.08	0.98266	0.00578	0.35791	0.3579	0.5141	0.6703	0.8265	0.9827
0	0	1	0	0	0	0	0	359.05	0.98670	0.00578	0.35791	0.3579	0.5151	0.6723	0.8295	0.9867
0	0	0	1	1	1	1	1	614.56	0.97724	0.00117	0.87044	0.8704	0.8971	0.9238	0.9505	0.9772
0	0	0	1	1	1	1	0	505.54	0.98128	0.00117	0.87044	0.8704	0.8982	0.9259	0.9536	0.9813
0	0	0	1	1	1	0	1	551.20	0.97959	0.00004	0.99556	0.9956	0.9916	0.9876	0.9836	0.9796
0	0	0	1	1	1	0	0	442.18	0.98362	0.00004	0.99556	0.9956	0.9926	0.9896	0.9866	0.9836
0	0	0	1	1	0	1	1	486.32	0.98199	0.00117	0.87044	0.8704	0.8983	0.9262	0.9541	0.9820
0	0	0	1	1	0	1	0	377.30	0.98603	0.00117	0.87044	0.8704	0.8993	0.9282	0.9571	0.9860
0	0	0	1	1	0	0	1	422.96	0.98433	0.00004	0.99556	0.9956	0.9928	0.9899	0.9871	0.9843
0	0	0	1	1	0	0	0	313.94	0.98837	0.00004	0.99556	0.9956	0.9938	0.9920	0.9902	0.9884
0	0	0	1	0	1	1	1	391.89	0.98549	0.00113	0.87488	0.8749	0.9025	0.9302	0.9578	0.9855
0	0	0	1	0	1	1	0	282.87	0.98952	0.00113	0.87488	0.8749	0.9035	0.9322	0.9609	0.9895
0	0	0	1	0	1	0	1	328.53	0.98783	0.00000	1.00000	1.0000	0.9970	0.9939	0.9909	0.9878
0	0	0	1	0	1	0	0	219.51	0.99187	0.00000	1.00000	1.0000	0.9980	0.9959	0.9939	0.9919
0	0	0	1	0	0	1	1	263.65	0.99024	0.00113	0.87488	0.8749	0.9037	0.9326	0.9614	0.9902
0	0	0	1	0	0	1	0	154.63	0.99427	0.00113	0.87488	0.8749	0.9047	0.9346	0.9644	0.9943
0	0	0	1	0	0	0	1	200.29	0.99258	0.00000	1.00000	1.0000	0.9981	0.9963	0.9944	0.9926
0	0	0	1	0	0	0	0	91.27	0.99662	0.00000	1.00000	1.0000	0.9992	0.9983	0.9975	0.9966
0	0	0	0	1	1	1	1	523.30	0.98062	0.00117	0.87044	0.8704	0.8980	0.9255	0.9531	0.9806
0	0	0	0	1	1	1	0	414.27	0.98466	0.00117	0.87044	0.8704	0.8990	0.9276	0.9561	0.9847
0	0	0	0	1	1	0	1	459.94	0.98297	0.00004	0.99556	0.9956	0.9924	0.9893	0.9861	0.9830
0	0	0	0	1	1	0	0	350.91	0.98700	0.00004	0.99556	0.9956	0.9934	0.9913	0.9891	0.9870
0	0	0	0	1	0	1	1	395.05	0.98537	0.00117	0.87044	0.8704	0.8992	0.9279	0.9566	0.9854
0	0	0	0	1	0	1	0	286.03	0.98941	0.00117	0.87044	0.8704	0.9002	0.9299	0.9597	0.9894
0	0	0	0	1	0	0	1	331.69	0.98772	0.00004	0.99556	0.9956	0.9936	0.9916	0.9897	0.9877
0	0	0	0	1	0	0	0	222.67	0.99175	0.00004	0.99556	0.9956	0.9946	0.9937	0.9927	0.9918
0	0	0	0	0	1	1	1	300.63	0.98887	0.00113	0.87488	0.8749	0.9034	0.9319	0.9604	0.9889
0	0	0	0	0	1	1	0	191.60	0.99290	0.00113	0.87488	0.8749	0.9044	0.9339	0.9634	0.9929
0	0	0	0	0	1	0	1	237.27	0.99121	0.00000	1.00000	1.0000	0.9978	0.9956	0.9934	0.9912
0	0	0	0	0	1	0	0	128.24	0.99525	0.00000	1.00000	1.0000	0.9988	0.9976	0.9964	0.9953
0	0	0	0	0	0	1	1	172.38	0.99362	0.00113	0.87488	0.8749	0.9046	0.9342	0.9639	0.9936
0	0	0	0	0	0	1	0	63.36	0.99765	0.00113	0.87488	0.8749	0.9056	0.9363	0.9670	0.9977
0	0	0	0	0	0	0	1	109.02	0.99596	0.00000	1.00000	1.0000	0.9990	0.9980	0.9970	0.9960
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 20% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	22,077.87	0.1823	0.0071	0.2163	0.2163	0.2078	0.1993	0.1908	0.1823
1	1	1	1	1	1	1	0	22,023.35	0.1843	0.0071	0.2163	0.2163	0.2083	0.2003	0.1923	0.1843
1	1	1	1	1	1	0	1	22,046.19	0.1835	0.0065	0.2789	0.2789	0.2551	0.2312	0.2073	0.1835
1	1	1	1	1	1	0	0	21,991.67	0.1855	0.0065	0.2789	0.2789	0.2556	0.2322	0.2088	0.1855
1	1	1	1	1	0	1	1	21,975.27	0.1861	0.0071	0.2163	0.2163	0.2088	0.2012	0.1937	0.1861
1	1	1	1	1	0	1	0	21,920.76	0.1881	0.0071	0.2163	0.2163	0.2093	0.2022	0.1952	0.1881
1	1	1	1	1	0	0	1	21,943.59	0.1873	0.0065	0.2789	0.2789	0.2560	0.2331	0.2102	0.1873
1	1	1	1	1	0	0	0	21,889.08	0.1893	0.0065	0.2789	0.2789	0.2565	0.2341	0.2117	0.1893
1	1	1	1	0	1	1	1	21,899.73	0.1889	0.0070	0.2208	0.2208	0.2128	0.2048	0.1969	0.1889
1	1	1	1	0	1	1	0	21,845.22	0.1909	0.0070	0.2208	0.2208	0.2133	0.2059	0.1984	0.1909
1	1	1	1	0	1	0	1	21,868.05	0.1901	0.0064	0.2833	0.2833	0.2600	0.2367	0.2134	0.1901
1	1	1	1	0	1	0	0	21,813.54	0.1921	0.0064	0.2833	0.2833	0.2605	0.2377	0.2149	0.1921
1	1	1	1	0	0	1	1	21,797.13	0.1927	0.0070	0.2208	0.2208	0.2138	0.2067	0.1997	0.1927
1	1	1	1	0	0	1	0	21,742.62	0.1947	0.0070	0.2208	0.2208	0.2143	0.2078	0.2012	0.1947
1	1	1	1	0	0	0	1	21,765.45	0.1939	0.0064	0.2833	0.2833	0.2610	0.2386	0.2162	0.1939
1	1	1	1	0	0	0	0	21,710.94	0.1959	0.0064	0.2833	0.2833	0.2615	0.2396	0.2178	0.1959
1	1	1	0	1	1	1	1	22,009.42	0.1848	0.0071	0.2163	0.2163	0.2085	0.2006	0.1927	0.1848
1	1	1	0	1	1	1	0	21,954.90	0.1869	0.0071	0.2163	0.2163	0.2090	0.2016	0.1942	0.1869
1	1	1	0	1	1	0	1	21,977.74	0.1860	0.0065	0.2789	0.2789	0.2557	0.2325	0.2092	0.1860
1	1	1	0	1	1	0	0	21,923.22	0.1880	0.0065	0.2789	0.2789	0.2562	0.2335	0.2107	0.1880
1	1	1	0	1	0	1	1	21,906.82	0.1886	0.0071	0.2163	0.2163	0.2094	0.2025	0.1956	0.1886
1	1	1	0	1	0	1	0	21,852.31	0.1907	0.0071	0.2163	0.2163	0.2099	0.2035	0.1971	0.1907
1	1	1	0	1	0	0	1	21,875.14	0.1898	0.0065	0.2789	0.2789	0.2566	0.2344	0.2121	0.1898
1	1	1	0	1	0	0	0	21,820.63	0.1918	0.0065	0.2789	0.2789	0.2571	0.2354	0.2136	0.1918
1	1	1	0	0	1	1	1	21,831.28	0.1914	0.0070	0.2208	0.2208	0.2134	0.2061	0.1988	0.1914
1	1	1	0	0	1	1	0	21,776.77	0.1935	0.0070	0.2208	0.2208	0.2140	0.2071	0.2003	0.1935
1	1	1	0	0	1	0	1	21,799.60	0.1926	0.0064	0.2833	0.2833	0.2607	0.2380	0.2153	0.1926
1	1	1	0	0	1	0	0	21,745.09	0.1946	0.0064	0.2833	0.2833	0.2612	0.2390	0.2168	0.1946
1	1	1	0	0	0	1	1	21,728.68	0.1952	0.0070	0.2208	0.2208	0.2144	0.2080	0.2016	0.1952
1	1	1	0	0	0	1	0	21,674.17	0.1973	0.0070	0.2208	0.2208	0.2149	0.2090	0.2031	0.1973
1	1	1	0	0	0	0	1	21,697.00	0.1964	0.0064	0.2833	0.2833	0.2616	0.2399	0.2181	0.1964
1	1	1	0	0	0	0	0	21,642.49	0.1984	0.0064	0.2833	0.2833	0.2621	0.2409	0.2197	0.1984
1	1	0	1	1	1	1	1	21,808.57	0.1923	0.0019	0.7942	0.7942	0.6437	0.4933	0.3428	0.1923
1	1	0	1	1	1	1	0	21,754.06	0.1943	0.0019	0.7942	0.7942	0.6442	0.4943	0.3443	0.1943
1	1	0	1	1	1	0	1	21,776.89	0.1934	0.0013	0.8568	0.8568	0.6910	0.5251	0.3593	0.1934
1	1	0	1	1	1	0	0	21,722.38	0.1955	0.0013	0.8568	0.8568	0.6915	0.5261	0.3608	0.1955
1	1	0	1	1	0	1	1	21,705.98	0.1961	0.0019	0.7942	0.7942	0.6447	0.4952	0.3456	0.1961
1	1	0	1	1	0	1	0	21,651.47	0.1981	0.0019	0.7942	0.7942	0.6452	0.4962	0.3471	0.1981
1	1	0	1	1	0	0	1	21,674.30	0.1972	0.0013	0.8568	0.8568	0.6919	0.5270	0.3621	0.1972
1	1	0	1	1	0	0	0	21,619.79	0.1993	0.0013	0.8568	0.8568	0.6924	0.5280	0.3636	0.1993
1	1	0	1	0	1	1	1	21,630.44	0.1989	0.0018	0.7987	0.7987	0.6487	0.4988	0.3488	0.1989
1	1	0	1	0	1	1	0	21,575.93	0.2009	0.0018	0.7987	0.7987	0.6492	0.4998	0.3503	0.2009
1	1	0	1	0	1	0	1	21,598.76	0.2000	0.0012	0.8612	0.8612	0.6959	0.5306	0.3653	0.2000
1	1	0	1	0	1	0	0	21,544.25	0.2021	0.0012	0.8612	0.8612	0.6964	0.5316	0.3669	0.2021
1	1	0	1	0	0	1	1	21,527.84	0.2027	0.0018	0.7987	0.7987	0.6497	0.5007	0.3517	0.2027
1	1	0	1	0	0	1	0	21,473.33	0.2047	0.0018	0.7987	0.7987	0.6502	0.5017	0.3532	0.2047
1	1	0	1	0	0	0	1	21,496.16	0.2038	0.0012	0.8612	0.8612	0.6969	0.5325	0.3682	0.2038
1	1	0	1	0	0	0	0	21,441.65	0.2059	0.0012	0.8612	0.8612	0.6974	0.5335	0.3697	0.2059
1	1	0	0	1	1	1	1	21,740.12	0.1948	0.0019	0.7942	0.7942	0.6444	0.4945	0.3447	0.1948
1	1	0	0	1	1	1	0	21,685.61	0.1968	0.0019	0.7942	0.7942	0.6449	0.4955	0.3462	0.1968
1	1	0	0	1	1	0	1	21,708.44	0.1960	0.0013	0.8568	0.8568	0.6916	0.5264	0.3612	0.1960
1	1	0	0	1	1	0	0	21,653.93	0.1980	0.0013	0.8568	0.8568	0.6921	0.5274	0.3627	0.1980
1	1	0	0	1	0	1	1	21,637.53	0.1986	0.0019	0.7942	0.7942	0.6453	0.4964	0.3475	0.1986
1	1	0	0	1	0	1	0	21,583.02	0.2006	0.0019	0.7942	0.7942	0.6458	0.4974	0.3490	0.2006
1	1	0	0	1	0	0	1	21,605.85	0.1998	0.0013	0.8568	0.8568	0.6925	0.5283	0.3640	0.1998
1	1	0	0	1	0	0	0	21,551.34	0.2018	0.0013	0.8568	0.8568	0.6930	0.5293	0.3655	0.2018
1	1	0	0	0	1	1	1	21,561.99	0.2014	0.0018	0.7987	0.7987	0.6493	0.5000	0.3507	0.2014
1	1	0	0	0	1	1	0	21,507.48	0.2034	0.0018	0.7987	0.7987	0.6499	0.5010	0.3522	0.2034
1	1	0	0	0	1	0	1	21,530.31	0.2026	0.0012	0.8612	0.8612	0.6966	0.5319	0.3672	0.2026
1	1	0	0	0	1	0	0	21,475.80	0.2046	0.0012	0.8612	0.8612	0.6971	0.5329	0.3688	0.2046
1	1	0	0	0	0	1	1	21,459.39	0.2052	0.0018	0.7987	0.7987	0.6503	0.5019	0.3536	0.2052
1	1	0	0	0	0	1	0	21,404.88	0.2072	0.0018	0.7987	0.7987	0.6508	0.5029	0.3551	0.2072
1	1	0	0	0	0	0	1	21,427.71	0.2064	0.0012	0.8612	0.8612	0.6975	0.5338	0.3701	0.2064
1	1	0	0	0	0	0	0	21,373.20	0.2084	0.0012	0.8612	0.8612	0.6980	0.5348	0.3716	0.2084

Risk Scenarios for 20% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	21,849.17	0.19077	0.00705	0.21635	0.2163	0.2100	0.2036	0.1972	0.1908
1	0	1	1	1	1	1	0	21,794.66	0.19279	0.00705	0.21635	0.2163	0.2105	0.2046	0.1987	0.1928
1	0	1	1	1	1	0	1	21,817.49	0.19194	0.00649	0.27891	0.2789	0.2572	0.2354	0.2137	0.1919
1	0	1	1	1	1	0	0	21,762.98	0.19396	0.00649	0.27891	0.2789	0.2577	0.2364	0.2152	0.1940
1	0	1	1	1	0	1	1	21,746.57	0.19457	0.00705	0.21635	0.2163	0.2109	0.2055	0.2000	0.1946
1	0	1	1	1	0	1	0	21,692.06	0.19659	0.00705	0.21635	0.2163	0.2114	0.2065	0.2015	0.1966
1	0	1	1	1	0	0	1	21,714.89	0.19574	0.00649	0.27891	0.2789	0.2581	0.2373	0.2165	0.1957
1	0	1	1	1	0	0	0	21,660.38	0.19776	0.00649	0.27891	0.2789	0.2586	0.2383	0.2180	0.1978
1	0	1	1	0	1	1	1	21,671.03	0.19737	0.00701	0.22079	0.2208	0.2149	0.2091	0.2032	0.1974
1	0	1	1	0	1	1	0	21,616.52	0.19939	0.00701	0.22079	0.2208	0.2154	0.2101	0.2047	0.1994
1	0	1	1	0	1	0	1	21,639.35	0.19854	0.00645	0.28335	0.2833	0.2621	0.2409	0.2197	0.1985
1	0	1	1	0	1	0	0	21,584.84	0.20056	0.00645	0.28335	0.2833	0.2626	0.2420	0.2213	0.2006
1	0	1	1	0	0	1	1	21,568.44	0.20117	0.00701	0.22079	0.2208	0.2159	0.2110	0.2061	0.2012
1	0	1	1	0	0	1	0	21,513.93	0.20319	0.00701	0.22079	0.2208	0.2164	0.2120	0.2076	0.2032
1	0	1	1	0	0	0	1	21,536.76	0.20234	0.00645	0.28335	0.2833	0.2631	0.2428	0.2226	0.2023
1	0	1	1	0	0	0	0	21,482.25	0.20436	0.00645	0.28335	0.2833	0.2636	0.2439	0.2241	0.2044
1	0	1	0	1	1	1	1	21,780.72	0.19331	0.00705	0.21635	0.2163	0.2106	0.2048	0.1991	0.1933
1	0	1	0	1	1	1	0	21,726.21	0.19533	0.00705	0.21635	0.2163	0.2111	0.2058	0.2006	0.1953
1	0	1	0	1	1	0	1	21,749.04	0.19448	0.00649	0.27891	0.2789	0.2578	0.2367	0.2156	0.1945
1	0	1	0	1	1	0	0	21,694.53	0.19650	0.00649	0.27891	0.2789	0.2583	0.2377	0.2171	0.1965
1	0	1	0	1	0	1	1	21,678.12	0.19711	0.00705	0.21635	0.2163	0.2115	0.2067	0.2019	0.1971
1	0	1	0	1	0	1	0	21,623.61	0.19913	0.00705	0.21635	0.2163	0.2120	0.2077	0.2034	0.1991
1	0	1	0	1	0	0	1	21,646.44	0.19828	0.00649	0.27891	0.2789	0.2588	0.2386	0.2184	0.1983
1	0	1	0	1	0	0	0	21,591.93	0.20030	0.00649	0.27891	0.2789	0.2593	0.2396	0.2200	0.2003
1	0	1	0	0	1	1	1	21,602.58	0.19990	0.00701	0.22079	0.2208	0.2156	0.2103	0.2051	0.1999
1	0	1	0	0	1	1	0	21,548.07	0.20192	0.00701	0.22079	0.2208	0.2161	0.2114	0.2066	0.2019
1	0	1	0	0	1	0	1	21,570.90	0.20108	0.00645	0.28335	0.2833	0.2628	0.2422	0.2216	0.2011
1	0	1	0	0	1	0	0	21,516.39	0.20310	0.00645	0.28335	0.2833	0.2633	0.2432	0.2232	0.2031
1	0	1	0	0	0	1	1	21,499.99	0.20370	0.00701	0.22079	0.2208	0.2165	0.2122	0.2080	0.2037
1	0	1	0	0	0	1	0	21,445.48	0.20572	0.00701	0.22079	0.2208	0.2170	0.2133	0.2095	0.2057
1	0	1	0	0	0	0	1	21,468.31	0.20488	0.00645	0.28335	0.2833	0.2637	0.2441	0.2245	0.2049
1	0	1	0	0	0	0	0	21,413.80	0.20690	0.00645	0.28335	0.2833	0.2642	0.2451	0.2260	0.2069
1	0	0	1	1	1	1	1	21,579.88	0.20075	0.00185	0.79423	0.7942	0.6459	0.4975	0.3491	0.2007
1	0	0	1	1	1	1	0	21,525.37	0.20276	0.00185	0.79423	0.7942	0.6464	0.4985	0.3506	0.2028
1	0	0	1	1	1	0	1	21,548.20	0.20192	0.00129	0.85679	0.8568	0.6931	0.5294	0.3656	0.2019
1	0	0	1	1	1	0	0	21,493.69	0.20394	0.00129	0.85679	0.8568	0.6936	0.5304	0.3671	0.2039
1	0	0	1	1	0	1	1	21,477.28	0.20455	0.00185	0.79423	0.7942	0.6468	0.4994	0.3520	0.2045
1	0	0	1	1	0	1	0	21,422.77	0.20656	0.00185	0.79423	0.7942	0.6473	0.5004	0.3535	0.2066
1	0	0	1	1	0	0	1	21,445.60	0.20572	0.00129	0.85679	0.8568	0.6940	0.5313	0.3685	0.2057
1	0	0	1	1	0	0	0	21,391.09	0.20774	0.00129	0.85679	0.8568	0.6945	0.5323	0.3700	0.2077
1	0	0	1	0	1	1	1	21,401.74	0.20734	0.00181	0.79866	0.7987	0.6508	0.5030	0.3552	0.2073
1	0	0	1	0	1	1	0	21,347.23	0.20936	0.00181	0.79866	0.7987	0.6513	0.5040	0.3567	0.2094
1	0	0	1	0	1	0	1	21,370.06	0.20852	0.00125	0.86122	0.8612	0.6980	0.5349	0.3717	0.2085
1	0	0	1	0	1	0	0	21,315.55	0.21054	0.00125	0.86122	0.8612	0.6986	0.5359	0.3732	0.2105
1	0	0	1	0	0	1	1	21,299.15	0.21114	0.00181	0.79866	0.7987	0.6518	0.5049	0.3580	0.2111
1	0	0	1	0	0	1	0	21,244.64	0.21316	0.00181	0.79866	0.7987	0.6523	0.5059	0.3595	0.2132
1	0	0	1	0	0	0	1	21,267.47	0.21232	0.00125	0.86122	0.8612	0.6990	0.5368	0.3745	0.2123
1	0	0	1	0	0	0	0	21,212.96	0.21433	0.00125	0.86122	0.8612	0.6995	0.5378	0.3761	0.2143
1	0	0	0	1	1	1	1	21,511.43	0.20328	0.00185	0.79423	0.7942	0.6465	0.4988	0.3510	0.2033
1	0	0	0	1	1	1	0	21,456.92	0.20530	0.00185	0.79423	0.7942	0.6470	0.4998	0.3525	0.2053
1	0	0	0	1	1	0	1	21,479.75	0.20445	0.00129	0.85679	0.8568	0.6937	0.5306	0.3675	0.2045
1	0	0	0	1	1	0	0	21,425.24	0.20647	0.00129	0.85679	0.8568	0.6942	0.5316	0.3691	0.2065
1	0	0	0	1	0	1	1	21,408.83	0.20708	0.00185	0.79423	0.7942	0.6474	0.5007	0.3539	0.2071
1	0	0	0	1	0	1	0	21,354.32	0.20910	0.00185	0.79423	0.7942	0.6479	0.5017	0.3554	0.2091
1	0	0	0	1	0	0	1	21,377.15	0.20825	0.00129	0.85679	0.8568	0.6947	0.5325	0.3704	0.2083
1	0	0	0	1	0	0	0	21,322.64	0.21027	0.00129	0.85679	0.8568	0.6952	0.5335	0.3719	0.2103
1	0	0	0	0	1	1	1	21,333.29	0.20988	0.00181	0.79866	0.7987	0.6515	0.5043	0.3571	0.2099
1	0	0	0	0	1	1	0	21,278.78	0.21190	0.00181	0.79866	0.7987	0.6520	0.5053	0.3586	0.2119
1	0	0	0	0	1	0	1	21,301.61	0.21105	0.00125	0.86122	0.8612	0.6987	0.5361	0.3736	0.2111
1	0	0	0	0	1	0	0	21,247.10	0.21307	0.00125	0.86122	0.8612	0.6992	0.5371	0.3751	0.2131
1	0	0	0	0	0	1	1	21,230.70	0.21368	0.00181	0.79866	0.7987	0.6524	0.5062	0.3599	0.2137
1	0	0	0	0	0	1	0	21,176.19	0.21570	0.00181	0.79866	0.7987	0.6529	0.5072	0.3614	0.2157
1	0	0	0	0	0	0	1	21,199.02	0.21485	0.00125	0.86122	0.8612	0.6996	0.5380	0.3764	0.2149
1	0	0	0	0	0	0	0	21,144.51	0.21687	0.00125	0.86122	0.8612	0.7001	0.5390	0.3780	0.2169

Risk Scenarios for 20% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	933.36	0.96543	0.00580	0.35513	0.3551	0.5077	0.6603	0.8129	0.9654
0	1	1	1	1	1	1	0	878.85	0.96745	0.00580	0.35513	0.3551	0.5082	0.6613	0.8144	0.9675
0	1	1	1	1	1	0	1	901.68	0.96660	0.00524	0.41769	0.4177	0.5549	0.6921	0.8294	0.9666
0	1	1	1	1	1	0	0	847.17	0.96862	0.00524	0.41769	0.4177	0.5554	0.6932	0.8309	0.9686
0	1	1	1	1	0	1	1	830.76	0.96923	0.00580	0.35513	0.3551	0.5087	0.6622	0.8157	0.9692
0	1	1	1	1	0	1	0	776.25	0.97125	0.00580	0.35513	0.3551	0.5092	0.6632	0.8172	0.9712
0	1	1	1	1	0	0	1	799.08	0.97040	0.00524	0.41769	0.4177	0.5559	0.6940	0.8322	0.9704
0	1	1	1	1	0	0	0	744.57	0.97242	0.00524	0.41769	0.4177	0.5564	0.6951	0.8337	0.9724
0	1	1	1	0	1	1	1	755.22	0.97203	0.00576	0.35956	0.3596	0.5127	0.6658	0.8189	0.9720
0	1	1	1	0	1	1	0	700.71	0.97405	0.00576	0.35956	0.3596	0.5132	0.6668	0.8204	0.9740
0	1	1	1	0	1	0	1	723.54	0.97320	0.00520	0.42212	0.4221	0.5599	0.6977	0.8354	0.9732
0	1	1	1	0	1	0	0	669.03	0.97522	0.00520	0.42212	0.4221	0.5604	0.6987	0.8369	0.9752
0	1	1	1	0	0	1	1	652.63	0.97583	0.00576	0.35956	0.3596	0.5136	0.6677	0.8218	0.9758
0	1	1	1	0	0	1	0	598.12	0.97785	0.00576	0.35956	0.3596	0.5141	0.6687	0.8233	0.9778
0	1	1	1	0	0	0	1	620.95	0.97700	0.00520	0.42212	0.4221	0.5608	0.6996	0.8383	0.9770
0	1	1	1	0	0	0	0	566.44	0.97902	0.00520	0.42212	0.4221	0.5613	0.7006	0.8398	0.9790
0	1	1	0	1	1	1	1	864.91	0.96797	0.00580	0.35513	0.3551	0.5083	0.6615	0.8148	0.9680
0	1	1	0	1	1	1	0	810.40	0.96999	0.00580	0.35513	0.3551	0.5088	0.6626	0.8163	0.9700
0	1	1	0	1	1	0	1	833.23	0.96914	0.00524	0.41769	0.4177	0.5555	0.6934	0.8313	0.9691
0	1	1	0	1	1	0	0	778.72	0.97116	0.00524	0.41769	0.4177	0.5561	0.6944	0.8328	0.9712
0	1	1	0	1	0	1	1	762.32	0.97177	0.00580	0.35513	0.3551	0.5093	0.6634	0.8176	0.9718
0	1	1	0	1	0	1	0	707.80	0.97379	0.00580	0.35513	0.3551	0.5098	0.6645	0.8191	0.9738
0	1	1	0	1	0	0	1	730.64	0.97294	0.00524	0.41769	0.4177	0.5565	0.6953	0.8341	0.9729
0	1	1	0	1	0	0	0	676.12	0.97496	0.00524	0.41769	0.4177	0.5570	0.6963	0.8356	0.9750
0	1	1	0	0	1	1	1	686.77	0.97456	0.00576	0.35956	0.3596	0.5133	0.6671	0.8208	0.9746
0	1	1	0	0	1	1	0	632.26	0.97658	0.00576	0.35956	0.3596	0.5138	0.6681	0.8223	0.9766
0	1	1	0	0	1	0	1	655.09	0.97574	0.00520	0.42212	0.4221	0.5605	0.6989	0.8373	0.9757
0	1	1	0	0	1	0	0	600.58	0.97776	0.00520	0.42212	0.4221	0.5610	0.6999	0.8388	0.9778
0	1	1	0	0	0	1	1	584.18	0.97836	0.00576	0.35956	0.3596	0.5143	0.6690	0.8237	0.9784
0	1	1	0	0	0	1	0	529.67	0.98038	0.00576	0.35956	0.3596	0.5148	0.6700	0.8252	0.9804
0	1	1	0	0	0	0	1	552.50	0.97954	0.00520	0.42212	0.4221	0.5615	0.7008	0.8402	0.9795
0	1	1	0	0	0	0	0	497.99	0.98156	0.00520	0.42212	0.4221	0.5620	0.7018	0.8417	0.9816
0	1	0	1	1	1	1	1	664.07	0.97540	0.00060	0.93300	0.9330	0.9436	0.9542	0.9648	0.9754
0	1	0	1	1	1	1	0	609.56	0.97742	0.00060	0.93300	0.9330	0.9441	0.9552	0.9663	0.9774
0	1	0	1	1	1	0	1	632.39	0.97658	0.00004	0.99556	0.9956	0.9908	0.9861	0.9813	0.9766
0	1	0	1	1	1	0	0	577.88	0.97860	0.00004	0.99556	0.9956	0.9913	0.9871	0.9828	0.9786
0	1	0	1	1	0	1	1	561.47	0.97920	0.00060	0.93300	0.9330	0.9446	0.9561	0.9677	0.9792
0	1	0	1	1	0	1	0	506.96	0.98122	0.00060	0.93300	0.9330	0.9451	0.9571	0.9692	0.9812
0	1	0	1	1	0	0	1	529.79	0.98038	0.00004	0.99556	0.9956	0.9918	0.9880	0.9842	0.9804
0	1	0	1	1	0	0	0	475.28	0.98240	0.00004	0.99556	0.9956	0.9923	0.9890	0.9857	0.9824
0	1	0	1	0	1	1	1	485.93	0.98200	0.00056	0.93744	0.9374	0.9486	0.9597	0.9709	0.9820
0	1	0	1	0	1	1	0	431.42	0.98402	0.00056	0.93744	0.9374	0.9491	0.9607	0.9724	0.9840
0	1	0	1	0	1	0	1	454.25	0.98318	0.00000	1.00000	1.0000	0.9958	0.9916	0.9874	0.9832
0	1	0	1	0	1	0	0	399.74	0.98519	0.00000	1.00000	1.0000	0.9963	0.9926	0.9889	0.9852
0	1	0	1	0	0	1	1	383.34	0.98580	0.00056	0.93744	0.9374	0.9495	0.9616	0.9737	0.9858
0	1	0	1	0	0	1	0	328.83	0.98782	0.00056	0.93744	0.9374	0.9500	0.9626	0.9752	0.9878
0	1	0	1	0	0	0	1	351.66	0.98698	0.00000	1.00000	1.0000	0.9967	0.9935	0.9902	0.9870
0	1	0	1	0	0	0	0	297.15	0.98899	0.00000	1.00000	1.0000	0.9972	0.9945	0.9917	0.9890
0	1	0	0	1	1	1	1	595.62	0.97794	0.00060	0.93300	0.9330	0.9442	0.9555	0.9667	0.9779
0	1	0	0	1	1	1	0	541.11	0.97996	0.00060	0.93300	0.9330	0.9447	0.9565	0.9682	0.9800
0	1	0	0	1	1	0	1	563.94	0.97911	0.00004	0.99556	0.9956	0.9915	0.9873	0.9832	0.9791
0	1	0	0	1	1	0	0	509.43	0.98113	0.00004	0.99556	0.9956	0.9920	0.9883	0.9847	0.9811
0	1	0	0	1	0	1	1	493.02	0.98174	0.00060	0.93300	0.9330	0.9452	0.9574	0.9696	0.9817
0	1	0	0	1	0	1	0	438.51	0.98376	0.00060	0.93300	0.9330	0.9457	0.9584	0.9711	0.9838
0	1	0	0	1	0	0	1	461.34	0.98291	0.00004	0.99556	0.9956	0.9924	0.9892	0.9861	0.9829
0	1	0	0	1	0	0	0	406.83	0.98493	0.00004	0.99556	0.9956	0.9929	0.9902	0.9876	0.9849
0	1	0	0	0	1	1	1	417.48	0.98454	0.00056	0.93744	0.9374	0.9492	0.9610	0.9728	0.9845
0	1	0	0	0	1	1	0	362.97	0.98656	0.00056	0.93744	0.9374	0.9497	0.9620	0.9743	0.9866
0	1	0	0	0	1	0	1	385.80	0.98571	0.00000	1.00000	1.0000	0.9964	0.9929	0.9893	0.9857
0	1	0	0	0	1	0	0	331.29	0.98773	0.00000	1.00000	1.0000	0.9969	0.9939	0.9908	0.9877
0	1	0	0	0	0	1	1	314.89	0.98834	0.00056	0.93744	0.9374	0.9502	0.9629	0.9756	0.9883
0	1	0	0	0	0	1	0	260.38	0.99036	0.00056	0.93744	0.9374	0.9507	0.9639	0.9771	0.9904
0	1	0	0	0	0	0	1	283.21	0.98951	0.00000	1.00000	1.0000	0.9974	0.9948	0.9921	0.9895
0	1	0	0	0	0	0	0	228.70	0.99153	0.00000	1.00000	1.0000	0.9979	0.9958	0.9936	0.9915

Risk Scenarios for 20% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	704.66	0.97390	0.00580	0.35513	0.3551	0.5098	0.6645	0.8192	0.9739
0	0	1	1	1	1	1	0	650.15	0.97592	0.00580	0.35513	0.3551	0.5103	0.6655	0.8207	0.9759
0	0	1	1	1	1	0	1	672.98	0.97507	0.00524	0.41769	0.4177	0.5570	0.6964	0.8357	0.9751
0	0	1	1	1	1	0	0	618.47	0.97709	0.00524	0.41769	0.4177	0.5575	0.6974	0.8372	0.9771
0	0	1	1	1	0	1	1	602.07	0.97770	0.00580	0.35513	0.3551	0.5108	0.6664	0.8221	0.9777
0	0	1	1	1	0	1	0	547.56	0.97972	0.00580	0.35513	0.3551	0.5113	0.6674	0.8236	0.9797
0	0	1	1	1	0	0	1	570.39	0.97887	0.00524	0.41769	0.4177	0.5580	0.6983	0.8386	0.9789
0	0	1	1	1	0	0	0	515.88	0.98089	0.00524	0.41769	0.4177	0.5585	0.6993	0.8401	0.9809
0	0	1	1	0	1	1	1	526.53	0.98050	0.00576	0.35956	0.3596	0.5148	0.6700	0.8253	0.9805
0	0	1	1	0	1	1	0	472.01	0.98252	0.00576	0.35956	0.3596	0.5153	0.6710	0.8268	0.9825
0	0	1	1	0	1	0	1	494.85	0.98167	0.00520	0.42212	0.4221	0.5620	0.7019	0.8418	0.9817
0	0	1	1	0	1	0	0	440.33	0.98369	0.00520	0.42212	0.4221	0.5625	0.7029	0.8433	0.9837
0	0	1	1	0	0	1	1	423.93	0.98430	0.00576	0.35956	0.3596	0.5157	0.6719	0.8281	0.9843
0	0	1	1	0	0	1	0	369.42	0.98632	0.00576	0.35956	0.3596	0.5163	0.6729	0.8296	0.9863
0	0	1	1	0	0	0	1	392.25	0.98547	0.00520	0.42212	0.4221	0.5630	0.7038	0.8446	0.9855
0	0	1	1	0	0	0	0	337.74	0.98749	0.00520	0.42212	0.4221	0.5635	0.7048	0.8461	0.9875
0	0	1	0	1	1	1	1	636.21	0.97644	0.00580	0.35513	0.3551	0.5105	0.6658	0.8211	0.9764
0	0	1	0	1	1	1	0	581.70	0.97846	0.00580	0.35513	0.3551	0.5110	0.6668	0.8226	0.9785
0	0	1	0	1	1	0	1	604.53	0.97761	0.00524	0.41769	0.4177	0.5577	0.6976	0.8376	0.9776
0	0	1	0	1	1	0	0	550.02	0.97963	0.00524	0.41769	0.4177	0.5582	0.6987	0.8391	0.9796
0	0	1	0	1	0	1	1	533.62	0.98024	0.00580	0.35513	0.3551	0.5114	0.6677	0.8240	0.9802
0	0	1	0	1	0	1	0	479.11	0.98226	0.00580	0.35513	0.3551	0.5119	0.6687	0.8255	0.9823
0	0	1	0	1	0	0	1	501.94	0.98141	0.00524	0.41769	0.4177	0.5586	0.6995	0.8405	0.9814
0	0	1	0	1	0	0	0	447.43	0.98343	0.00524	0.41769	0.4177	0.5591	0.7006	0.8420	0.9834
0	0	1	0	0	1	1	1	458.08	0.98303	0.00576	0.35956	0.3596	0.5154	0.6713	0.8272	0.9830
0	0	1	0	0	1	1	0	403.56	0.98505	0.00576	0.35956	0.3596	0.5159	0.6723	0.8287	0.9851
0	0	1	0	0	1	0	1	426.40	0.98421	0.00520	0.42212	0.4221	0.5626	0.7032	0.8437	0.9842
0	0	1	0	0	1	0	0	371.88	0.98623	0.00520	0.42212	0.4221	0.5631	0.7042	0.8452	0.9862
0	0	1	0	0	0	1	1	355.48	0.98683	0.00576	0.35956	0.3596	0.5164	0.6732	0.8300	0.9868
0	0	1	0	0	0	1	0	300.97	0.98885	0.00576	0.35956	0.3596	0.5169	0.6742	0.8315	0.9889
0	0	1	0	0	0	0	1	323.80	0.98801	0.00520	0.42212	0.4221	0.5636	0.7051	0.8465	0.9880
0	0	1	0	0	0	0	0	269.29	0.99003	0.00520	0.42212	0.4221	0.5641	0.7061	0.8481	0.9900
0	0	0	1	1	1	1	1	435.37	0.98388	0.00060	0.93300	0.9330	0.9457	0.9584	0.9712	0.9839
0	0	0	1	1	1	1	0	380.86	0.98589	0.00060	0.93300	0.9330	0.9462	0.9594	0.9727	0.9859
0	0	0	1	1	1	0	1	403.69	0.98505	0.00004	0.99556	0.9956	0.9929	0.9903	0.9877	0.9850
0	0	0	1	1	1	0	0	349.18	0.98707	0.00004	0.99556	0.9956	0.9934	0.9913	0.9892	0.9871
0	0	0	1	1	0	1	1	332.78	0.98767	0.00060	0.93300	0.9330	0.9467	0.9603	0.9740	0.9877
0	0	0	1	1	0	1	0	278.27	0.98969	0.00060	0.93300	0.9330	0.9472	0.9613	0.9755	0.9897
0	0	0	1	1	0	0	1	301.10	0.98885	0.00004	0.99556	0.9956	0.9939	0.9922	0.9905	0.9888
0	0	0	1	1	0	0	0	246.59	0.99087	0.00004	0.99556	0.9956	0.9944	0.9932	0.9920	0.9909
0	0	0	1	0	1	1	1	257.24	0.99047	0.00056	0.93744	0.9374	0.9507	0.9640	0.9772	0.9905
0	0	0	1	0	1	1	0	202.72	0.99249	0.00056	0.93744	0.9374	0.9512	0.9650	0.9787	0.9925
0	0	0	1	0	1	0	1	225.56	0.99165	0.00000	1.00000	1.0000	0.9979	0.9958	0.9937	0.9916
0	0	0	1	0	1	0	0	171.04	0.99367	0.00000	1.00000	1.0000	0.9984	0.9968	0.9952	0.9937
0	0	0	1	0	0	1	1	154.64	0.99427	0.00056	0.93744	0.9374	0.9516	0.9659	0.9801	0.9943
0	0	0	1	0	0	1	0	100.13	0.99629	0.00056	0.93744	0.9374	0.9522	0.9669	0.9816	0.9963
0	0	0	1	0	0	0	1	122.96	0.99545	0.00000	1.00000	1.0000	0.9989	0.9977	0.9966	0.9954
0	0	0	1	0	0	0	0	68.45	0.99746	0.00000	1.00000	1.0000	0.9994	0.9987	0.9981	0.9975
0	0	0	0	1	1	1	1	366.92	0.98641	0.00060	0.93300	0.9330	0.9464	0.9597	0.9731	0.9864
0	0	0	0	1	1	1	0	312.41	0.98843	0.00060	0.93300	0.9330	0.9469	0.9607	0.9746	0.9884
0	0	0	0	1	1	0	1	335.24	0.98758	0.00004	0.99556	0.9956	0.9936	0.9916	0.9896	0.9876
0	0	0	0	1	1	0	0	280.73	0.98960	0.00004	0.99556	0.9956	0.9941	0.9926	0.9911	0.9896
0	0	0	0	1	0	1	1	264.33	0.99021	0.00060	0.93300	0.9330	0.9473	0.9616	0.9759	0.9902
0	0	0	0	1	0	1	0	209.82	0.99223	0.00060	0.93300	0.9330	0.9478	0.9626	0.9774	0.9922
0	0	0	0	1	0	0	1	232.65	0.99138	0.00004	0.99556	0.9956	0.9945	0.9935	0.9924	0.9914
0	0	0	0	1	0	0	0	178.14	0.99340	0.00004	0.99556	0.9956	0.9950	0.9945	0.9939	0.9934
0	0	0	0	0	1	1	1	188.79	0.99301	0.00056	0.93744	0.9374	0.9513	0.9652	0.9791	0.9930
0	0	0	0	0	1	1	0	134.27	0.99503	0.00056	0.93744	0.9374	0.9518	0.9662	0.9806	0.9950
0	0	0	0	0	1	0	1	157.11	0.99418	0.00000	1.00000	1.0000	0.9985	0.9971	0.9956	0.9942
0	0	0	0	0	1	0	0	102.59	0.99620	0.00000	1.00000	1.0000	0.9991	0.9981	0.9972	0.9962
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 30% ML (1 ="Occur"; 0 ="No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	19,443.19	0.2799	0.0058	0.3600	0.3600	0.3400	0.3200	0.2999	0.2799
1	1	1	1	1	1	1	0	19,388.67	0.2819	0.0058	0.3600	0.3600	0.3405	0.3210	0.3014	0.2819
1	1	1	1	1	1	0	1	19,411.51	0.2811	0.0052	0.4226	0.4226	0.3872	0.3518	0.3164	0.2811
1	1	1	1	1	1	0	0	19,356.99	0.2831	0.0052	0.4226	0.4226	0.3877	0.3528	0.3180	0.2831
1	1	1	1	1	0	1	1	19,359.83	0.2830	0.0058	0.3600	0.3600	0.3408	0.3215	0.3022	0.2830
1	1	1	1	1	0	1	0	19,305.32	0.2850	0.0058	0.3600	0.3600	0.3413	0.3225	0.3038	0.2850
1	1	1	1	1	0	0	1	19,328.15	0.2841	0.0052	0.4226	0.4226	0.3880	0.3534	0.3188	0.2841
1	1	1	1	1	0	0	0	19,273.64	0.2862	0.0052	0.4226	0.4226	0.3885	0.3544	0.3203	0.2862
1	1	1	1	0	1	1	1	19,298.45	0.2852	0.0057	0.3638	0.3638	0.3442	0.3245	0.3049	0.2852
1	1	1	1	0	1	1	0	19,243.94	0.2873	0.0057	0.3638	0.3638	0.3447	0.3255	0.3064	0.2873
1	1	1	1	0	1	0	1	19,266.77	0.2864	0.0052	0.4264	0.4264	0.3914	0.3564	0.3214	0.2864
1	1	1	1	0	1	0	0	19,212.26	0.2884	0.0052	0.4264	0.4264	0.3919	0.3574	0.3229	0.2884
1	1	1	1	0	0	1	1	19,215.09	0.2883	0.0057	0.3638	0.3638	0.3449	0.3261	0.3072	0.2883
1	1	1	1	0	0	1	0	19,160.58	0.2903	0.0057	0.3638	0.3638	0.3454	0.3271	0.3087	0.2903
1	1	1	1	0	0	0	1	19,183.41	0.2895	0.0052	0.4264	0.4264	0.3922	0.3579	0.3237	0.2895
1	1	1	1	0	0	0	0	19,128.90	0.2915	0.0052	0.4264	0.4264	0.3927	0.3589	0.3252	0.2915
1	1	1	0	1	1	1	1	19,388.43	0.2819	0.0058	0.3600	0.3600	0.3405	0.3210	0.3014	0.2819
1	1	1	0	1	1	1	0	19,333.91	0.2839	0.0058	0.3600	0.3600	0.3410	0.3220	0.3030	0.2839
1	1	1	0	1	1	0	1	19,356.75	0.2831	0.0052	0.4226	0.4226	0.3877	0.3528	0.3180	0.2831
1	1	1	0	1	1	0	0	19,302.23	0.2851	0.0052	0.4226	0.4226	0.3882	0.3539	0.3195	0.2851
1	1	1	0	1	0	1	1	19,305.07	0.2850	0.0058	0.3600	0.3600	0.3413	0.3225	0.3038	0.2850
1	1	1	0	1	0	1	0	19,250.56	0.2870	0.0058	0.3600	0.3600	0.3418	0.3235	0.3053	0.2870
1	1	1	0	1	0	0	1	19,273.39	0.2862	0.0052	0.4226	0.4226	0.3885	0.3544	0.3203	0.2862
1	1	1	0	1	0	0	0	19,218.88	0.2882	0.0052	0.4226	0.4226	0.3890	0.3554	0.3218	0.2882
1	1	1	0	0	1	1	1	19,243.69	0.2873	0.0057	0.3638	0.3638	0.3447	0.3255	0.3064	0.2873
1	1	1	0	0	1	1	0	19,189.18	0.2893	0.0057	0.3638	0.3638	0.3452	0.3266	0.3079	0.2893
1	1	1	0	0	1	0	1	19,212.01	0.2884	0.0052	0.4264	0.4264	0.3919	0.3574	0.3229	0.2884
1	1	1	0	0	1	0	0	19,157.50	0.2905	0.0052	0.4264	0.4264	0.3924	0.3584	0.3244	0.2905
1	1	1	0	0	0	1	1	19,160.33	0.2904	0.0057	0.3638	0.3638	0.3454	0.3271	0.3087	0.2904
1	1	1	0	0	0	1	0	19,105.82	0.2924	0.0057	0.3638	0.3638	0.3460	0.3281	0.3102	0.2924
1	1	1	0	0	0	0	1	19,128.65	0.2915	0.0052	0.4264	0.4264	0.3927	0.3590	0.3252	0.2915
1	1	1	0	0	0	0	0	19,074.14	0.2936	0.0052	0.4264	0.4264	0.3932	0.3600	0.3268	0.2936
1	1	0	1	1	1	1	1	19,227.75	0.2879	0.0017	0.8095	0.8095	0.6791	0.5487	0.4183	0.2879
1	1	0	1	1	1	1	0	19,173.24	0.2899	0.0017	0.8095	0.8095	0.6796	0.5497	0.4198	0.2899
1	1	0	1	1	1	0	1	19,196.07	0.2890	0.0012	0.8721	0.8721	0.7263	0.5805	0.4348	0.2890
1	1	0	1	1	1	0	0	19,141.56	0.2911	0.0012	0.8721	0.8721	0.7268	0.5816	0.4363	0.2911
1	1	0	1	1	0	1	1	19,144.40	0.2909	0.0017	0.8095	0.8095	0.6799	0.5502	0.4206	0.2909
1	1	0	1	1	0	1	0	19,089.88	0.2930	0.0017	0.8095	0.8095	0.6804	0.5512	0.4221	0.2930
1	1	0	1	1	0	0	1	19,112.72	0.2921	0.0012	0.8721	0.8721	0.7271	0.5821	0.4371	0.2921
1	1	0	1	1	0	0	0	19,058.20	0.2941	0.0012	0.8721	0.8721	0.7276	0.5831	0.4386	0.2941
1	1	0	1	0	1	1	1	19,083.02	0.2932	0.0017	0.8133	0.8133	0.6833	0.5532	0.4232	0.2932
1	1	0	1	0	1	1	0	19,028.51	0.2952	0.0017	0.8133	0.8133	0.6838	0.5543	0.4247	0.2952
1	1	0	1	0	1	0	1	19,051.34	0.2944	0.0011	0.8758	0.8758	0.7305	0.5851	0.4398	0.2944
1	1	0	1	0	1	0	0	18,996.83	0.2964	0.0011	0.8758	0.8758	0.7310	0.5861	0.4413	0.2964
1	1	0	1	0	0	1	1	18,999.66	0.2963	0.0017	0.8133	0.8133	0.6840	0.5548	0.4255	0.2963
1	1	0	1	0	0	1	0	18,945.15	0.2983	0.0017	0.8133	0.8133	0.6845	0.5558	0.4271	0.2983
1	1	0	1	0	0	0	1	18,967.98	0.2975	0.0011	0.8758	0.8758	0.7312	0.5867	0.4421	0.2975
1	1	0	1	0	0	0	0	18,913.47	0.2995	0.0011	0.8758	0.8758	0.7317	0.5877	0.4436	0.2995
1	1	0	0	1	1	1	1	19,172.99	0.2899	0.0017	0.8095	0.8095	0.6796	0.5497	0.4198	0.2899
1	1	0	0	1	1	1	0	19,118.48	0.2919	0.0017	0.8095	0.8095	0.6801	0.5507	0.4213	0.2919
1	1	0	0	1	1	0	1	19,141.31	0.2911	0.0012	0.8721	0.8721	0.7268	0.5816	0.4363	0.2911
1	1	0	0	1	1	0	0	19,086.80	0.2931	0.0012	0.8721	0.8721	0.7273	0.5826	0.4378	0.2931
1	1	0	0	1	0	1	1	19,089.64	0.2930	0.0017	0.8095	0.8095	0.6804	0.5512	0.4221	0.2930
1	1	0	0	1	0	1	0	19,035.12	0.2950	0.0017	0.8095	0.8095	0.6809	0.5522	0.4236	0.2950
1	1	0	0	1	0	0	1	19,057.96	0.2941	0.0012	0.8721	0.8721	0.7276	0.5831	0.4386	0.2941
1	1	0	0	1	0	0	0	19,003.44	0.2962	0.0012	0.8721	0.8721	0.7281	0.5841	0.4401	0.2962
1	1	0	0	0	1	1	1	19,028.26	0.2952	0.0017	0.8133	0.8133	0.6838	0.5543	0.4248	0.2952
1	1	0	0	0	1	1	0	18,973.75	0.2973	0.0017	0.8133	0.8133	0.6843	0.5553	0.4263	0.2973
1	1	0	0	0	1	0	1	18,996.58	0.2964	0.0011	0.8758	0.8758	0.7310	0.5861	0.4413	0.2964
1	1	0	0	0	1	0	0	18,942.07	0.2984	0.0011	0.8758	0.8758	0.7315	0.5871	0.4428	0.2984
1	1	0	0	0	0	1	1	18,944.90	0.2983	0.0017	0.8133	0.8133	0.6845	0.5558	0.4271	0.2983
1	1	0	0	0	0	1	0	18,890.39	0.3004	0.0017	0.8133	0.8133	0.6850	0.5568	0.4286	0.3004
1	1	0	0	0	0	0	1	18,913.22	0.2995	0.0011	0.8758	0.8758	0.7318	0.5877	0.4436	0.2995
1	1	0	0	0	0	0	0	18,858.71	0.3015	0.0011	0.8758	0.8758	0.7323	0.5887	0.4451	0.3015

Risk Scenarios for 30% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	19,241.39	0.28736	0.00576	0.36004	0.3600	0.3419	0.3237	0.3055	0.2874
1	0	1	1	1	1	1	0	19,186.88	0.28937	0.00576	0.36004	0.3600	0.3424	0.3247	0.3070	0.2894
1	0	1	1	1	1	0	1	19,209.71	0.28853	0.00520	0.42260	0.4226	0.3891	0.3556	0.3220	0.2885
1	0	1	1	1	1	0	0	19,155.20	0.29055	0.00520	0.42260	0.4226	0.3896	0.3566	0.3236	0.2905
1	0	1	1	1	0	1	1	19,158.04	0.29044	0.00576	0.36004	0.3600	0.3426	0.3252	0.3078	0.2904
1	0	1	1	1	0	1	0	19,103.53	0.29246	0.00576	0.36004	0.3600	0.3431	0.3263	0.3094	0.2925
1	0	1	1	1	0	0	1	19,126.36	0.29162	0.00520	0.42260	0.4226	0.3899	0.3571	0.3244	0.2916
1	0	1	1	1	0	0	0	19,071.85	0.29364	0.00520	0.42260	0.4226	0.3904	0.3581	0.3259	0.2936
1	0	1	1	0	1	1	1	19,096.66	0.29272	0.00573	0.36381	0.3638	0.3460	0.3283	0.3105	0.2927
1	0	1	1	0	1	1	0	19,042.15	0.29474	0.00573	0.36381	0.3638	0.3465	0.3293	0.3120	0.2947
1	0	1	1	0	1	0	1	19,064.98	0.29389	0.00516	0.42637	0.4264	0.3933	0.3601	0.3270	0.2939
1	0	1	1	0	1	0	0	19,010.47	0.29591	0.00516	0.42637	0.4264	0.3938	0.3611	0.3285	0.2959
1	0	1	1	0	0	1	1	19,013.30	0.29580	0.00573	0.36381	0.3638	0.3468	0.3298	0.3128	0.2958
1	0	1	1	0	0	1	0	18,958.79	0.29782	0.00573	0.36381	0.3638	0.3473	0.3308	0.3143	0.2978
1	0	1	1	0	0	0	1	18,981.62	0.29698	0.00516	0.42637	0.4264	0.3940	0.3617	0.3293	0.2970
1	0	1	1	0	0	0	0	18,927.11	0.29900	0.00516	0.42637	0.4264	0.3945	0.3627	0.3308	0.2990
1	0	1	0	1	1	1	1	19,186.63	0.28938	0.00576	0.36004	0.3600	0.3424	0.3247	0.3070	0.2894
1	0	1	0	1	1	1	0	19,132.12	0.29140	0.00576	0.36004	0.3600	0.3429	0.3257	0.3086	0.2914
1	0	1	0	1	1	0	1	19,154.95	0.29056	0.00520	0.42260	0.4226	0.3896	0.3566	0.3236	0.2906
1	0	1	0	1	1	0	0	19,100.44	0.29258	0.00520	0.42260	0.4226	0.3901	0.3576	0.3251	0.2926
1	0	1	0	1	0	1	1	19,103.28	0.29247	0.00576	0.36004	0.3600	0.3431	0.3263	0.3094	0.2925
1	0	1	0	1	0	1	0	19,048.77	0.29449	0.00576	0.36004	0.3600	0.3437	0.3273	0.3109	0.2945
1	0	1	0	1	0	0	1	19,071.60	0.29364	0.00520	0.42260	0.4226	0.3904	0.3581	0.3259	0.2936
1	0	1	0	1	0	0	0	19,017.09	0.29566	0.00520	0.42260	0.4226	0.3909	0.3591	0.3274	0.2957
1	0	1	0	0	1	1	1	19,041.90	0.29474	0.00573	0.36381	0.3638	0.3465	0.3293	0.3120	0.2947
1	0	1	0	0	1	1	0	18,987.39	0.29676	0.00573	0.36381	0.3638	0.3470	0.3303	0.3135	0.2968
1	0	1	0	0	1	0	1	19,010.22	0.29592	0.00516	0.42637	0.4264	0.3938	0.3611	0.3285	0.2959
1	0	1	0	0	1	0	0	18,955.71	0.29794	0.00516	0.42637	0.4264	0.3943	0.3622	0.3300	0.2979
1	0	1	0	0	0	1	1	18,958.54	0.29783	0.00573	0.36381	0.3638	0.3473	0.3308	0.3143	0.2978
1	0	1	0	0	0	1	0	18,904.03	0.29985	0.00573	0.36381	0.3638	0.3478	0.3318	0.3158	0.2999
1	0	1	0	0	0	0	1	18,926.86	0.29901	0.00516	0.42637	0.4264	0.3945	0.3627	0.3308	0.2990
1	0	1	0	0	0	0	0	18,872.35	0.30102	0.00516	0.42637	0.4264	0.3950	0.3637	0.3324	0.3010
1	0	0	1	1	1	1	1	19,025.96	0.29533	0.00171	0.80950	0.8095	0.6810	0.5524	0.4239	0.2953
1	0	0	1	1	1	1	0	18,971.45	0.29735	0.00171	0.80950	0.8095	0.6815	0.5534	0.4254	0.2974
1	0	0	1	1	1	0	1	18,994.28	0.29651	0.00115	0.87206	0.8721	0.7282	0.5843	0.4404	0.2965
1	0	0	1	1	1	0	0	18,939.77	0.29853	0.00115	0.87206	0.8721	0.7287	0.5853	0.4419	0.2985
1	0	0	1	1	0	1	1	18,942.60	0.29842	0.00171	0.80950	0.8095	0.6817	0.5540	0.4262	0.2984
1	0	0	1	1	0	1	0	18,888.09	0.30044	0.00171	0.80950	0.8095	0.6822	0.5550	0.4277	0.3004
1	0	0	1	1	0	0	1	18,910.92	0.29960	0.00115	0.87206	0.8721	0.7289	0.5858	0.4427	0.2996
1	0	0	1	1	0	0	0	18,856.41	0.30161	0.00115	0.87206	0.8721	0.7294	0.5868	0.4442	0.3016
1	0	0	1	0	1	1	1	18,881.23	0.30070	0.00168	0.81327	0.8133	0.6851	0.5570	0.4288	0.3007
1	0	0	1	0	1	1	0	18,826.71	0.30271	0.00168	0.81327	0.8133	0.6856	0.5580	0.4304	0.3027
1	0	0	1	0	1	0	1	18,849.55	0.30187	0.00112	0.87583	0.8758	0.7323	0.5889	0.4454	0.3019
1	0	0	1	0	1	0	0	18,795.03	0.30389	0.00112	0.87583	0.8758	0.7328	0.5899	0.4469	0.3039
1	0	0	1	0	0	1	1	18,797.87	0.30378	0.00168	0.81327	0.8133	0.6859	0.5585	0.4312	0.3038
1	0	0	1	0	0	1	0	18,743.36	0.30580	0.00168	0.81327	0.8133	0.6864	0.5595	0.4327	0.3058
1	0	0	1	0	0	0	1	18,766.19	0.30496	0.00112	0.87583	0.8758	0.7331	0.5904	0.4477	0.3050
1	0	0	1	0	0	0	0	18,711.68	0.30697	0.00112	0.87583	0.8758	0.7336	0.5914	0.4492	0.3070
1	0	0	0	1	1	1	1	18,971.20	0.29736	0.00171	0.80950	0.8095	0.6815	0.5534	0.4254	0.2974
1	0	0	0	1	1	1	0	18,916.69	0.29938	0.00171	0.80950	0.8095	0.6820	0.5544	0.4269	0.2994
1	0	0	0	1	1	0	1	18,939.52	0.29854	0.00115	0.87206	0.8721	0.7287	0.5853	0.4419	0.2985
1	0	0	0	1	1	0	0	18,885.01	0.30056	0.00115	0.87206	0.8721	0.7292	0.5863	0.4434	0.3006
1	0	0	0	1	0	1	1	18,887.84	0.30045	0.00171	0.80950	0.8095	0.6822	0.5550	0.4277	0.3005
1	0	0	0	1	0	1	0	18,833.33	0.30247	0.00171	0.80950	0.8095	0.6827	0.5560	0.4292	0.3025
1	0	0	0	1	0	0	1	18,856.16	0.30162	0.00115	0.87206	0.8721	0.7295	0.5868	0.4442	0.3016
1	0	0	0	1	0	0	0	18,801.65	0.30364	0.00115	0.87206	0.8721	0.7300	0.5879	0.4457	0.3036
1	0	0	0	0	1	1	1	18,826.47	0.30272	0.00168	0.81327	0.8133	0.6856	0.5580	0.4304	0.3027
1	0	0	0	0	1	1	0	18,771.95	0.30474	0.00168	0.81327	0.8133	0.6861	0.5590	0.4319	0.3047
1	0	0	0	0	1	0	1	18,794.79	0.30390	0.00112	0.87583	0.8758	0.7328	0.5899	0.4469	0.3039
1	0	0	0	0	1	0	0	18,740.27	0.30592	0.00112	0.87583	0.8758	0.7334	0.5909	0.4484	0.3059
1	0	0	0	0	0	1	1	18,743.11	0.30581	0.00168	0.81327	0.8133	0.6864	0.5595	0.4327	0.3058
1	0	0	0	0	0	1	0	18,688.60	0.30783	0.00168	0.81327	0.8133	0.6869	0.5606	0.4342	0.3078
1	0	0	0	0	0	0	1	18,711.43	0.30698	0.00112	0.87583	0.8758	0.7336	0.5914	0.4492	0.3070
1	0	0	0	0	0	0	0	18,656.92	0.30900	0.00112	0.87583	0.8758	0.7341	0.5924	0.4507	0.3090

Risk Scenarios for 30% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	786.27	0.97088	0.00464	0.48421	0.4842	0.6059	0.7275	0.8492	0.9709
0	1	1	1	1	1	1	0	731.76	0.97290	0.00464	0.48421	0.4842	0.6064	0.7286	0.8507	0.9729
0	1	1	1	1	1	0	1	754.59	0.97205	0.00408	0.54677	0.5468	0.6531	0.7594	0.8657	0.9721
0	1	1	1	1	1	0	0	700.08	0.97407	0.00408	0.54677	0.5468	0.6536	0.7604	0.8672	0.9741
0	1	1	1	1	0	1	1	702.91	0.97397	0.00464	0.48421	0.4842	0.6066	0.7291	0.8515	0.9740
0	1	1	1	1	0	1	0	648.40	0.97599	0.00464	0.48421	0.4842	0.6072	0.7301	0.8530	0.9760
0	1	1	1	1	0	0	1	671.23	0.97514	0.00408	0.54677	0.5468	0.6539	0.7610	0.8680	0.9751
0	1	1	1	1	0	0	0	616.72	0.97716	0.00408	0.54677	0.5468	0.6544	0.7620	0.8696	0.9772
0	1	1	1	0	1	1	1	641.53	0.97624	0.00461	0.48798	0.4880	0.6100	0.7321	0.8542	0.9762
0	1	1	1	0	1	1	0	587.02	0.97826	0.00461	0.48798	0.4880	0.6105	0.7331	0.8557	0.9783
0	1	1	1	0	1	0	1	609.85	0.97741	0.00405	0.55054	0.5505	0.6573	0.7640	0.8707	0.9774
0	1	1	1	0	1	0	0	555.34	0.97943	0.00405	0.55054	0.5505	0.6578	0.7650	0.8722	0.9794
0	1	1	1	0	0	1	1	558.17	0.97933	0.00461	0.48798	0.4880	0.6108	0.7337	0.8565	0.9793
0	1	1	1	0	0	1	0	503.66	0.98135	0.00461	0.48798	0.4880	0.6113	0.7347	0.8580	0.9813
0	1	1	1	0	0	0	1	526.49	0.98050	0.00405	0.55054	0.5505	0.6580	0.7655	0.8730	0.9805
0	1	1	1	0	0	0	0	471.98	0.98252	0.00405	0.55054	0.5505	0.6585	0.7665	0.8745	0.9825
0	1	1	0	1	1	1	1	731.51	0.97291	0.00464	0.48421	0.4842	0.6064	0.7286	0.8507	0.9729
0	1	1	0	1	1	1	0	677.00	0.97493	0.00464	0.48421	0.4842	0.6069	0.7296	0.8522	0.9749
0	1	1	0	1	1	0	1	699.83	0.97408	0.00408	0.54677	0.5468	0.6536	0.7604	0.8673	0.9741
0	1	1	0	1	1	0	0	645.32	0.97610	0.00408	0.54677	0.5468	0.6541	0.7614	0.8688	0.9761
0	1	1	0	1	0	1	1	648.15	0.97599	0.00464	0.48421	0.4842	0.6072	0.7301	0.8530	0.9760
0	1	1	0	1	0	1	0	593.64	0.97801	0.00464	0.48421	0.4842	0.6077	0.7311	0.8546	0.9780
0	1	1	0	1	0	0	1	616.47	0.97717	0.00408	0.54677	0.5468	0.6544	0.7620	0.8696	0.9772
0	1	1	0	1	0	0	0	561.96	0.97919	0.00408	0.54677	0.5468	0.6549	0.7630	0.8711	0.9792
0	1	1	0	0	1	1	1	586.77	0.97827	0.00461	0.48798	0.4880	0.6106	0.7331	0.8557	0.9783
0	1	1	0	0	1	1	0	532.26	0.98029	0.00461	0.48798	0.4880	0.6111	0.7341	0.8572	0.9803
0	1	1	0	0	1	0	1	555.09	0.97944	0.00405	0.55054	0.5505	0.6578	0.7650	0.8722	0.9794
0	1	1	0	0	1	0	0	500.58	0.98146	0.00405	0.55054	0.5505	0.6583	0.7660	0.8737	0.9815
0	1	1	0	0	0	1	1	503.41	0.98136	0.00461	0.48798	0.4880	0.6113	0.7347	0.8580	0.9814
0	1	1	0	0	0	1	0	448.90	0.98337	0.00461	0.48798	0.4880	0.6118	0.7357	0.8595	0.9834
0	1	1	0	0	0	0	1	471.73	0.98253	0.00405	0.55054	0.5505	0.6585	0.7665	0.8745	0.9825
0	1	1	0	0	0	0	0	417.22	0.98455	0.00405	0.55054	0.5505	0.6590	0.7675	0.8760	0.9845
0	1	0	1	1	1	1	1	570.84	0.97886	0.00060	0.93367	0.9337	0.9450	0.9563	0.9676	0.9789
0	1	0	1	1	1	1	0	516.33	0.98088	0.00060	0.93367	0.9337	0.9455	0.9573	0.9691	0.9809
0	1	0	1	1	1	0	1	539.16	0.98003	0.00003	0.99623	0.9962	0.9922	0.9881	0.9841	0.9800
0	1	0	1	1	1	0	0	484.65	0.98205	0.00003	0.99623	0.9962	0.9927	0.9891	0.9856	0.9821
0	1	0	1	1	0	1	1	487.48	0.98195	0.00060	0.93367	0.9337	0.9457	0.9578	0.9699	0.9819
0	1	0	1	1	0	1	0	432.97	0.98396	0.00060	0.93367	0.9337	0.9462	0.9588	0.9714	0.9840
0	1	0	1	1	0	0	1	455.80	0.98312	0.00003	0.99623	0.9962	0.9930	0.9897	0.9864	0.9831
0	1	0	1	1	0	0	0	401.29	0.98514	0.00003	0.99623	0.9962	0.9935	0.9907	0.9879	0.9851
0	1	0	1	0	1	1	1	426.10	0.98422	0.00056	0.93744	0.9374	0.9491	0.9608	0.9725	0.9842
0	1	0	1	0	1	1	0	371.59	0.98624	0.00056	0.93744	0.9374	0.9496	0.9618	0.9740	0.9862
0	1	0	1	0	1	0	1	394.42	0.98539	0.00000	1.00000	1.0000	0.9963	0.9927	0.9890	0.9854
0	1	0	1	0	1	0	0	339.91	0.98741	0.00000	1.00000	1.0000	0.9969	0.9937	0.9906	0.9874
0	1	0	1	0	0	1	1	342.74	0.98731	0.00056	0.93744	0.9374	0.9499	0.9624	0.9748	0.9873
0	1	0	1	0	0	1	0	288.23	0.98932	0.00056	0.93744	0.9374	0.9504	0.9634	0.9764	0.9893
0	1	0	1	0	0	0	1	311.06	0.98848	0.00000	1.00000	1.0000	0.9971	0.9942	0.9914	0.9885
0	1	0	1	0	0	0	0	256.55	0.99050	0.00000	1.00000	1.0000	0.9976	0.9952	0.9929	0.9905
0	1	0	0	1	1	1	1	516.08	0.98089	0.00060	0.93367	0.9337	0.9455	0.9573	0.9691	0.9809
0	1	0	0	1	1	1	0	461.57	0.98290	0.00060	0.93367	0.9337	0.9460	0.9583	0.9706	0.9829
0	1	0	0	1	1	0	1	484.40	0.98206	0.00003	0.99623	0.9962	0.9927	0.9891	0.9856	0.9821
0	1	0	0	1	1	0	0	429.89	0.98408	0.00003	0.99623	0.9962	0.9932	0.9902	0.9871	0.9841
0	1	0	0	1	0	1	1	432.72	0.98397	0.00060	0.93367	0.9337	0.9462	0.9588	0.9714	0.9840
0	1	0	0	1	0	1	0	378.21	0.98599	0.00060	0.93367	0.9337	0.9468	0.9598	0.9729	0.9860
0	1	0	0	1	0	0	1	401.04	0.98515	0.00003	0.99623	0.9962	0.9935	0.9907	0.9879	0.9851
0	1	0	0	1	0	0	0	346.53	0.98717	0.00003	0.99623	0.9962	0.9940	0.9917	0.9894	0.9872
0	1	0	0	0	1	1	1	371.34	0.98625	0.00056	0.93744	0.9374	0.9496	0.9618	0.9740	0.9862
0	1	0	0	0	1	1	0	316.83	0.98827	0.00056	0.93744	0.9374	0.9501	0.9629	0.9756	0.9883
0	1	0	0	0	1	0	1	339.66	0.98742	0.00000	1.00000	1.0000	0.9969	0.9937	0.9906	0.9874
0	1	0	0	0	1	0	0	285.15	0.98944	0.00000	1.00000	1.0000	0.9974	0.9947	0.9921	0.9894
0	1	0	0	0	0	1	1	287.98	0.98933	0.00056	0.93744	0.9374	0.9504	0.9634	0.9764	0.9893
0	1	0	0	0	0	1	0	233.47	0.99135	0.00056	0.93744	0.9374	0.9509	0.9644	0.9779	0.9914
0	1	0	0	0	0	0	1	256.30	0.99051	0.00000	1.00000	1.0000	0.9976	0.9953	0.9929	0.9905
0	1	0	0	0	0	0	0	201.79	0.99253	0.00000	1.00000	1.0000	0.9981	0.9963	0.9944	0.9925

Risk Scenarios for 30% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	584.48	0.97835	0.00464	0.48421	0.4842	0.6077	0.7313	0.8548	0.9784
0	0	1	1	1	1	1	0	529.97	0.98037	0.00464	0.48421	0.4842	0.6082	0.7323	0.8563	0.9804
0	0	1	1	1	1	0	1	552.80	0.97953	0.00408	0.54677	0.5468	0.6550	0.7631	0.8713	0.9795
0	0	1	1	1	1	0	0	498.29	0.98154	0.00408	0.54677	0.5468	0.6555	0.7642	0.8729	0.9815
0	0	1	1	1	0	1	1	501.12	0.98144	0.00464	0.48421	0.4842	0.6085	0.7328	0.8571	0.9814
0	0	1	1	1	0	1	0	446.61	0.98346	0.00464	0.48421	0.4842	0.6090	0.7338	0.8586	0.9835
0	0	1	1	1	0	0	1	469.44	0.98261	0.00408	0.54677	0.5468	0.6557	0.7647	0.8737	0.9826
0	0	1	1	1	0	0	0	414.93	0.98463	0.00408	0.54677	0.5468	0.6562	0.7657	0.8752	0.9846
0	0	1	1	0	1	1	1	439.74	0.98371	0.00461	0.48798	0.4880	0.6119	0.7358	0.8598	0.9837
0	0	1	1	0	1	1	0	385.23	0.98573	0.00461	0.48798	0.4880	0.6124	0.7369	0.8613	0.9857
0	0	1	1	0	1	0	1	408.06	0.98489	0.00405	0.55054	0.5505	0.6591	0.7677	0.8763	0.9849
0	0	1	1	0	1	0	0	353.55	0.98691	0.00405	0.55054	0.5505	0.6596	0.7687	0.8778	0.9869
0	0	1	1	0	0	1	1	356.38	0.98680	0.00461	0.48798	0.4880	0.6127	0.7374	0.8621	0.9868
0	0	1	1	0	0	1	0	301.87	0.98882	0.00461	0.48798	0.4880	0.6132	0.7384	0.8636	0.9888
0	0	1	1	0	0	0	1	324.70	0.98797	0.00405	0.55054	0.5505	0.6599	0.7693	0.8786	0.9880
0	0	1	1	0	0	0	0	270.19	0.98999	0.00405	0.55054	0.5505	0.6604	0.7703	0.8801	0.9900
0	0	1	0	1	1	1	1	529.72	0.98038	0.00464	0.48421	0.4842	0.6083	0.7323	0.8563	0.9804
0	0	1	0	1	1	1	0	475.21	0.98240	0.00464	0.48421	0.4842	0.6088	0.7333	0.8579	0.9824
0	0	1	0	1	1	0	1	498.04	0.98155	0.00408	0.54677	0.5468	0.6555	0.7642	0.8729	0.9816
0	0	1	0	1	1	0	0	443.53	0.98357	0.00408	0.54677	0.5468	0.6560	0.7652	0.8744	0.9836
0	0	1	0	1	0	1	1	446.36	0.98347	0.00464	0.48421	0.4842	0.6090	0.7338	0.8587	0.9835
0	0	1	0	1	0	1	0	391.85	0.98549	0.00464	0.48421	0.4842	0.6095	0.7348	0.8602	0.9855
0	0	1	0	1	0	0	1	414.68	0.98464	0.00408	0.54677	0.5468	0.6562	0.7657	0.8752	0.9846
0	0	1	0	1	0	0	0	360.17	0.98666	0.00408	0.54677	0.5468	0.6567	0.7667	0.8767	0.9867
0	0	1	0	0	1	1	1	384.98	0.98574	0.00461	0.48798	0.4880	0.6124	0.7369	0.8613	0.9857
0	0	1	0	0	1	1	0	330.47	0.98776	0.00461	0.48798	0.4880	0.6129	0.7379	0.8628	0.9878
0	0	1	0	0	1	0	1	353.30	0.98691	0.00405	0.55054	0.5505	0.6596	0.7687	0.8778	0.9869
0	0	1	0	0	1	0	0	298.79	0.98893	0.00405	0.55054	0.5505	0.6601	0.7697	0.8793	0.9889
0	0	1	0	0	0	1	1	301.62	0.98883	0.00461	0.48798	0.4880	0.6132	0.7384	0.8636	0.9888
0	0	1	0	0	0	1	0	247.11	0.99085	0.00461	0.48798	0.4880	0.6137	0.7394	0.8651	0.9908
0	0	1	0	0	0	0	1	269.94	0.99000	0.00405	0.55054	0.5505	0.6604	0.7703	0.8801	0.9900
0	0	1	0	0	0	0	0	215.43	0.99202	0.00405	0.55054	0.5505	0.6609	0.7713	0.8817	0.9920
0	0	0	1	1	1	1	1	369.05	0.98633	0.00060	0.93367	0.9337	0.9468	0.9600	0.9732	0.9863
0	0	0	1	1	1	1	0	314.53	0.98835	0.00060	0.93367	0.9337	0.9473	0.9610	0.9747	0.9884
0	0	0	1	1	1	0	1	337.37	0.98750	0.00003	0.99623	0.9962	0.9940	0.9919	0.9897	0.9875
0	0	0	1	1	1	0	0	282.85	0.98952	0.00003	0.99623	0.9962	0.9946	0.9929	0.9912	0.9895
0	0	0	1	1	0	1	1	285.69	0.98942	0.00060	0.93367	0.9337	0.9476	0.9615	0.9755	0.9894
0	0	0	1	1	0	1	0	231.18	0.99144	0.00060	0.93367	0.9337	0.9481	0.9626	0.9770	0.9914
0	0	0	1	1	0	0	1	254.01	0.99059	0.00003	0.99623	0.9962	0.9948	0.9934	0.9920	0.9906
0	0	0	1	1	0	0	0	199.50	0.99261	0.00003	0.99623	0.9962	0.9953	0.9944	0.9935	0.9926
0	0	0	1	0	1	1	1	224.31	0.99169	0.00056	0.93744	0.9374	0.9510	0.9646	0.9781	0.9917
0	0	0	1	0	1	1	0	169.80	0.99371	0.00056	0.93744	0.9374	0.9515	0.9656	0.9796	0.9937
0	0	0	1	0	1	0	1	192.63	0.99287	0.00000	1.00000	1.0000	0.9982	0.9964	0.9946	0.9929
0	0	0	1	0	1	0	0	138.12	0.99488	0.00000	1.00000	1.0000	0.9987	0.9974	0.9962	0.9949
0	0	0	1	0	0	1	1	140.95	0.99478	0.00056	0.93744	0.9374	0.9518	0.9661	0.9804	0.9948
0	0	0	1	0	0	1	0	86.44	0.99680	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	1	0	0	0	1	109.27	0.99595	0.00000	1.00000	1.0000	0.9990	0.9980	0.9970	0.9960
0	0	0	1	0	0	0	0	54.76	0.99797	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	1	1	1	1	314.29	0.98836	0.00060	0.93367	0.9337	0.9473	0.9610	0.9747	0.9884
0	0	0	0	1	1	1	0	259.77	0.99038	0.00060	0.93367	0.9337	0.9478	0.9620	0.9762	0.9904
0	0	0	0	1	1	0	1	282.61	0.98953	0.00003	0.99623	0.9962	0.9946	0.9929	0.9912	0.9895
0	0	0	0	1	1	0	0	228.09	0.99155	0.00003	0.99623	0.9962	0.9951	0.9939	0.9927	0.9916
0	0	0	0	1	0	1	1	230.93	0.99145	0.00060	0.93367	0.9337	0.9481	0.9626	0.9770	0.9914
0	0	0	0	1	0	1	0	176.42	0.99347	0.00060	0.93367	0.9337	0.9486	0.9636	0.9785	0.9935
0	0	0	0	1	0	0	1	199.25	0.99262	0.00003	0.99623	0.9962	0.9953	0.9944	0.9935	0.9926
0	0	0	0	1	0	0	0	144.74	0.99464	0.00003	0.99623	0.9962	0.9958	0.9954	0.9950	0.9946
0	0	0	0	0	1	1	1	169.55	0.99372	0.00056	0.93744	0.9374	0.9515	0.9656	0.9797	0.9937
0	0	0	0	0	1	1	0	115.04	0.99574	0.00056	0.93744	0.9374	0.9520	0.9666	0.9812	0.9957
0	0	0	0	0	1	0	1	137.87	0.99489	0.00000	1.00000	1.0000	0.9987	0.9974	0.9962	0.9949
0	0	0	0	0	1	0	0	83.36	0.99691	0.00000	1.00000	1.0000	0.9992	0.9985	0.9977	0.9969
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 40% ML (1 ="Occur"; 0 ="No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	18,128.33	0.3286	0.0051	0.4322	0.4322	0.4063	0.3804	0.3545	0.3286
1	1	1	1	1	1	1	0	18,073.82	0.3306	0.0051	0.4322	0.4322	0.4068	0.3814	0.3560	0.3306
1	1	1	1	1	1	0	1	18,096.65	0.3298	0.0045	0.4948	0.4948	0.4535	0.4123	0.3710	0.3298
1	1	1	1	1	1	0	0	18,042.14	0.3318	0.0045	0.4948	0.4948	0.4540	0.4133	0.3725	0.3318
1	1	1	1	1	0	1	1	18,057.80	0.3312	0.0051	0.4322	0.4322	0.4070	0.3817	0.3564	0.3312
1	1	1	1	1	0	1	0	18,003.29	0.3332	0.0051	0.4322	0.4322	0.4075	0.3827	0.3580	0.3332
1	1	1	1	1	0	0	1	18,026.12	0.3324	0.0045	0.4948	0.4948	0.4542	0.4136	0.3730	0.3324
1	1	1	1	1	0	0	0	17,971.61	0.3344	0.0045	0.4948	0.4948	0.4547	0.4146	0.3745	0.3344
1	1	1	1	0	1	1	1	18,005.86	0.3331	0.0051	0.4353	0.4353	0.4098	0.3842	0.3587	0.3331
1	1	1	1	0	1	1	0	17,951.35	0.3351	0.0051	0.4353	0.4353	0.4103	0.3852	0.3602	0.3351
1	1	1	1	0	1	0	1	17,974.18	0.3343	0.0045	0.4979	0.4979	0.4570	0.4161	0.3752	0.3343
1	1	1	1	0	1	0	0	17,919.67	0.3363	0.0045	0.4979	0.4979	0.4575	0.4171	0.3767	0.3363
1	1	1	1	0	0	1	1	17,935.33	0.3357	0.0051	0.4353	0.4353	0.4104	0.3855	0.3606	0.3357
1	1	1	1	0	0	1	0	17,880.82	0.3377	0.0051	0.4353	0.4353	0.4109	0.3865	0.3621	0.3377
1	1	1	1	0	0	0	1	17,903.65	0.3369	0.0045	0.4979	0.4979	0.4576	0.4174	0.3771	0.3369
1	1	1	1	0	0	0	0	17,849.14	0.3389	0.0045	0.4979	0.4979	0.4581	0.4184	0.3787	0.3389
1	1	1	0	1	1	1	1	18,078.13	0.3304	0.0051	0.4322	0.4322	0.4068	0.3813	0.3559	0.3304
1	1	1	0	1	1	1	0	18,023.62	0.3325	0.0051	0.4322	0.4322	0.4073	0.3823	0.3574	0.3325
1	1	1	0	1	1	0	1	18,046.45	0.3316	0.0045	0.4948	0.4948	0.4540	0.4132	0.3724	0.3316
1	1	1	0	1	1	0	0	17,991.94	0.3336	0.0045	0.4948	0.4948	0.4545	0.4142	0.3739	0.3336
1	1	1	0	1	0	1	1	18,007.60	0.3331	0.0051	0.4322	0.4322	0.4074	0.3826	0.3578	0.3331
1	1	1	0	1	0	1	0	17,953.09	0.3351	0.0051	0.4322	0.4322	0.4079	0.3836	0.3594	0.3351
1	1	1	0	1	0	0	1	17,975.92	0.3342	0.0045	0.4948	0.4948	0.4546	0.4145	0.3744	0.3342
1	1	1	0	1	0	0	0	17,921.41	0.3362	0.0045	0.4948	0.4948	0.4551	0.4155	0.3759	0.3362
1	1	1	0	0	1	1	1	17,955.67	0.3350	0.0051	0.4353	0.4353	0.4102	0.3851	0.3601	0.3350
1	1	1	0	0	1	1	0	17,901.15	0.3370	0.0051	0.4353	0.4353	0.4107	0.3862	0.3616	0.3370
1	1	1	0	0	1	0	1	17,923.99	0.3361	0.0045	0.4979	0.4979	0.4574	0.4170	0.3766	0.3361
1	1	1	0	0	1	0	0	17,869.47	0.3382	0.0045	0.4979	0.4979	0.4580	0.4180	0.3781	0.3382
1	1	1	0	0	0	1	1	17,885.13	0.3376	0.0051	0.4353	0.4353	0.4109	0.3865	0.3620	0.3376
1	1	1	0	0	0	1	0	17,830.62	0.3396	0.0051	0.4353	0.4353	0.4114	0.3875	0.3635	0.3396
1	1	1	0	0	0	0	1	17,853.45	0.3388	0.0045	0.4979	0.4979	0.4581	0.4183	0.3785	0.3388
1	1	1	0	0	0	0	0	17,798.94	0.3408	0.0045	0.4979	0.4979	0.4586	0.4193	0.3801	0.3408
1	1	0	1	1	1	1	1	17,930.85	0.3359	0.0016	0.8175	0.8175	0.6971	0.5767	0.4563	0.3359
1	1	0	1	1	1	1	0	17,876.34	0.3379	0.0016	0.8175	0.8175	0.6976	0.5777	0.4578	0.3379
1	1	0	1	1	1	0	1	17,899.17	0.3371	0.0011	0.8800	0.8800	0.7443	0.6085	0.4728	0.3371
1	1	0	1	1	1	0	0	17,844.66	0.3391	0.0011	0.8800	0.8800	0.7448	0.6096	0.4743	0.3391
1	1	0	1	1	0	1	1	17,860.32	0.3385	0.0016	0.8175	0.8175	0.6977	0.5780	0.4582	0.3385
1	1	0	1	1	0	1	0	17,805.81	0.3405	0.0016	0.8175	0.8175	0.6982	0.5790	0.4598	0.3405
1	1	0	1	1	0	0	1	17,828.64	0.3397	0.0011	0.8800	0.8800	0.7449	0.6099	0.4748	0.3397
1	1	0	1	1	0	0	0	17,774.13	0.3417	0.0011	0.8800	0.8800	0.7454	0.6109	0.4763	0.3417
1	1	0	1	0	1	1	1	17,808.38	0.3404	0.0016	0.8206	0.8206	0.7005	0.5805	0.4605	0.3404
1	1	0	1	0	1	1	0	17,753.87	0.3424	0.0016	0.8206	0.8206	0.7010	0.5815	0.4620	0.3424
1	1	0	1	0	1	0	1	17,776.70	0.3416	0.0011	0.8831	0.8831	0.7478	0.6124	0.4770	0.3416
1	1	0	1	0	1	0	0	17,722.19	0.3436	0.0011	0.8831	0.8831	0.7483	0.6134	0.4785	0.3436
1	1	0	1	0	0	1	1	17,737.85	0.3430	0.0016	0.8206	0.8206	0.7012	0.5818	0.4624	0.3430
1	1	0	1	0	0	1	0	17,683.34	0.3451	0.0016	0.8206	0.8206	0.7017	0.5828	0.4639	0.3451
1	1	0	1	0	0	0	1	17,706.17	0.3442	0.0011	0.8831	0.8831	0.7484	0.6137	0.4789	0.3442
1	1	0	1	0	0	0	0	17,651.66	0.3462	0.0011	0.8831	0.8831	0.7489	0.6147	0.4805	0.3462
1	1	0	0	1	1	1	1	17,880.65	0.3378	0.0016	0.8175	0.8175	0.6975	0.5776	0.4577	0.3378
1	1	0	0	1	1	1	0	17,826.14	0.3398	0.0016	0.8175	0.8175	0.6980	0.5786	0.4592	0.3398
1	1	0	0	1	1	0	1	17,848.97	0.3389	0.0011	0.8800	0.8800	0.7448	0.6095	0.4742	0.3389
1	1	0	0	1	1	0	0	17,794.46	0.3409	0.0011	0.8800	0.8800	0.7453	0.6105	0.4757	0.3409
1	1	0	0	1	0	1	1	17,810.12	0.3404	0.0016	0.8175	0.8175	0.6982	0.5789	0.4596	0.3404
1	1	0	0	1	0	1	0	17,755.61	0.3424	0.0016	0.8175	0.8175	0.6987	0.5799	0.4612	0.3424
1	1	0	0	1	0	0	1	17,778.44	0.3415	0.0011	0.8800	0.8800	0.7454	0.6108	0.4762	0.3415
1	1	0	0	1	0	0	0	17,723.93	0.3436	0.0011	0.8800	0.8800	0.7459	0.6118	0.4777	0.3436
1	1	0	0	0	1	1	1	17,758.19	0.3423	0.0016	0.8206	0.8206	0.7010	0.5814	0.4619	0.3423
1	1	0	0	0	1	1	0	17,703.67	0.3443	0.0016	0.8206	0.8206	0.7015	0.5824	0.4634	0.3443
1	1	0	0	0	1	0	1	17,726.51	0.3435	0.0011	0.8831	0.8831	0.7482	0.6133	0.4784	0.3435
1	1	0	0	0	1	0	0	17,671.99	0.3455	0.0011	0.8831	0.8831	0.7487	0.6143	0.4799	0.3455
1	1	0	0	0	0	1	1	17,687.65	0.3449	0.0016	0.8206	0.8206	0.7017	0.5827	0.4638	0.3449
1	1	0	0	0	0	1	0	17,633.14	0.3469	0.0016	0.8206	0.8206	0.7022	0.5837	0.4653	0.3469
1	1	0	0	0	0	0	1	17,655.97	0.3461	0.0011	0.8831	0.8831	0.7489	0.6146	0.4803	0.3461
1	1	0	0	0	0	0	0	17,601.46	0.3481	0.0011	0.8831	0.8831	0.7494	0.6156	0.4819	0.3481

Risk Scenarios for 40% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	17,939.99	0.33556	0.00511	0.43222	0.4322	0.4081	0.3839	0.3597	0.3356
1	0	1	1	1	1	1	0	17,885.48	0.33757	0.00511	0.43222	0.4322	0.4086	0.3849	0.3612	0.3376
1	0	1	1	1	1	0	1	17,908.31	0.33673	0.00455	0.49478	0.4948	0.4553	0.4158	0.3762	0.3367
1	0	1	1	1	1	0	0	17,853.80	0.33875	0.00455	0.49478	0.4948	0.4558	0.4168	0.3778	0.3387
1	0	1	1	1	0	1	1	17,869.46	0.33817	0.00511	0.43222	0.4322	0.4087	0.3852	0.3617	0.3382
1	0	1	1	1	0	1	0	17,814.95	0.34019	0.00511	0.43222	0.4322	0.4092	0.3862	0.3632	0.3402
1	0	1	1	1	0	0	1	17,837.78	0.33934	0.00455	0.49478	0.4948	0.4559	0.4171	0.3782	0.3393
1	0	1	1	1	0	0	0	17,783.27	0.34136	0.00455	0.49478	0.4948	0.4564	0.4181	0.3797	0.3414
1	0	1	1	0	1	1	1	17,817.52	0.34009	0.00508	0.43532	0.4353	0.4115	0.3877	0.3639	0.3401
1	0	1	1	0	1	1	0	17,763.01	0.34211	0.00508	0.43532	0.4353	0.4120	0.3887	0.3654	0.3421
1	0	1	1	0	1	0	1	17,785.84	0.34127	0.00452	0.49788	0.4979	0.4587	0.4196	0.3804	0.3413
1	0	1	1	0	1	0	0	17,731.33	0.34328	0.00452	0.49788	0.4979	0.4592	0.4206	0.3819	0.3433
1	0	1	1	0	0	1	1	17,746.99	0.34270	0.00508	0.43532	0.4353	0.4122	0.3890	0.3659	0.3427
1	0	1	1	0	0	1	0	17,692.48	0.34472	0.00508	0.43532	0.4353	0.4127	0.3900	0.3674	0.3447
1	0	1	1	0	0	0	1	17,715.31	0.34388	0.00452	0.49788	0.4979	0.4594	0.4209	0.3824	0.3439
1	0	1	1	0	0	0	0	17,660.80	0.34590	0.00452	0.49788	0.4979	0.4599	0.4219	0.3839	0.3459
1	0	1	0	1	1	1	1	17,889.80	0.33741	0.00511	0.43222	0.4322	0.4085	0.3848	0.3611	0.3374
1	0	1	0	1	1	1	0	17,835.29	0.33943	0.00511	0.43222	0.4322	0.4090	0.3858	0.3626	0.3394
1	0	1	0	1	1	0	1	17,858.12	0.33859	0.00455	0.49478	0.4948	0.4557	0.4167	0.3776	0.3386
1	0	1	0	1	1	0	0	17,803.61	0.34061	0.00455	0.49478	0.4948	0.4562	0.4177	0.3791	0.3406
1	0	1	0	1	0	1	1	17,819.26	0.34003	0.00511	0.43222	0.4322	0.4092	0.3861	0.3631	0.3400
1	0	1	0	1	0	1	0	17,764.75	0.34205	0.00511	0.43222	0.4322	0.4097	0.3871	0.3646	0.3420
1	0	1	0	1	0	0	1	17,787.58	0.34120	0.00455	0.49478	0.4948	0.4564	0.4180	0.3796	0.3412
1	0	1	0	1	0	0	0	17,733.07	0.34322	0.00455	0.49478	0.4948	0.4569	0.4190	0.3811	0.3432
1	0	1	0	0	1	1	1	17,767.33	0.34195	0.00508	0.43532	0.4353	0.4120	0.3886	0.3653	0.3420
1	0	1	0	0	1	1	0	17,712.82	0.34397	0.00508	0.43532	0.4353	0.4125	0.3896	0.3668	0.3440
1	0	1	0	0	1	0	1	17,735.65	0.34312	0.00452	0.49788	0.4979	0.4592	0.4205	0.3818	0.3431
1	0	1	0	0	1	0	0	17,681.14	0.34514	0.00452	0.49788	0.4979	0.4597	0.4215	0.3833	0.3451
1	0	1	0	0	0	1	1	17,696.79	0.34456	0.00508	0.43532	0.4353	0.4126	0.3899	0.3673	0.3446
1	0	1	0	0	0	1	0	17,642.28	0.34658	0.00508	0.43532	0.4353	0.4131	0.3910	0.3688	0.3466
1	0	1	0	0	0	0	1	17,665.11	0.34574	0.00452	0.49788	0.4979	0.4598	0.4218	0.3838	0.3457
1	0	1	0	0	0	0	0	17,610.60	0.34776	0.00452	0.49788	0.4979	0.4604	0.4228	0.3853	0.3478
1	0	0	1	1	1	1	1	17,742.51	0.34287	0.00164	0.81747	0.8175	0.6988	0.5802	0.4615	0.3429
1	0	0	1	1	1	1	0	17,688.00	0.34489	0.00164	0.81747	0.8175	0.6993	0.5812	0.4630	0.3449
1	0	0	1	1	1	0	1	17,710.83	0.34404	0.00108	0.88003	0.8800	0.7460	0.6120	0.4780	0.3440
1	0	0	1	1	1	0	0	17,656.32	0.34606	0.00108	0.88003	0.8800	0.7465	0.6130	0.4796	0.3461
1	0	0	1	1	0	1	1	17,671.98	0.34548	0.00164	0.81747	0.8175	0.6995	0.5815	0.4635	0.3455
1	0	0	1	1	0	1	0	17,617.47	0.34750	0.00164	0.81747	0.8175	0.7000	0.5825	0.4650	0.3475
1	0	0	1	1	0	0	1	17,640.30	0.34666	0.00108	0.88003	0.8800	0.7467	0.6133	0.4800	0.3467
1	0	0	1	1	0	0	0	17,585.79	0.34867	0.00108	0.88003	0.8800	0.7472	0.6144	0.4815	0.3487
1	0	0	1	0	1	1	1	17,620.04	0.34741	0.00161	0.82058	0.8206	0.7023	0.5840	0.4657	0.3474
1	0	0	1	0	1	1	0	17,565.53	0.34942	0.00161	0.82058	0.8206	0.7028	0.5850	0.4672	0.3494
1	0	0	1	0	1	0	1	17,588.36	0.34858	0.00105	0.88314	0.8831	0.7495	0.6159	0.4822	0.3486
1	0	0	1	0	1	0	0	17,533.85	0.35060	0.00105	0.88314	0.8831	0.7500	0.6169	0.4837	0.3506
1	0	0	1	0	0	1	1	17,549.51	0.35002	0.00161	0.82058	0.8206	0.7029	0.5853	0.4677	0.3500
1	0	0	1	0	0	1	0	17,495.00	0.35204	0.00161	0.82058	0.8206	0.7034	0.5863	0.4692	0.3520
1	0	0	1	0	0	0	1	17,517.83	0.35119	0.00105	0.88314	0.8831	0.7501	0.6172	0.4842	0.3512
1	0	0	1	0	0	0	0	17,463.32	0.35321	0.00105	0.88314	0.8831	0.7507	0.6182	0.4857	0.3532
1	0	0	0	1	1	1	1	17,692.32	0.34473	0.00164	0.81747	0.8175	0.6993	0.5811	0.4629	0.3447
1	0	0	0	1	1	1	0	17,637.81	0.34675	0.00164	0.81747	0.8175	0.6998	0.5821	0.4644	0.3467
1	0	0	0	1	1	0	1	17,660.64	0.34590	0.00108	0.88003	0.8800	0.7465	0.6130	0.4794	0.3459
1	0	0	0	1	1	0	0	17,606.13	0.34792	0.00108	0.88003	0.8800	0.7470	0.6140	0.4809	0.3479
1	0	0	0	1	0	1	1	17,621.78	0.34734	0.00164	0.81747	0.8175	0.6999	0.5824	0.4649	0.3473
1	0	0	0	1	0	1	0	17,567.27	0.34936	0.00164	0.81747	0.8175	0.7004	0.5834	0.4664	0.3494
1	0	0	0	1	0	0	1	17,590.10	0.34851	0.00108	0.88003	0.8800	0.7472	0.6143	0.4814	0.3485
1	0	0	0	1	0	0	0	17,535.59	0.35053	0.00108	0.88003	0.8800	0.7477	0.6153	0.4829	0.3505
1	0	0	0	0	1	1	1	17,569.85	0.34926	0.00161	0.82058	0.8206	0.7027	0.5849	0.4671	0.3493
1	0	0	0	0	1	1	0	17,515.34	0.35128	0.00161	0.82058	0.8206	0.7033	0.5859	0.4686	0.3513
1	0	0	0	0	1	0	1	17,538.17	0.35044	0.00105	0.88314	0.8831	0.7500	0.6168	0.4836	0.3504
1	0	0	0	0	1	0	0	17,483.66	0.35246	0.00105	0.88314	0.8831	0.7505	0.6178	0.4851	0.3525
1	0	0	0	0	0	1	1	17,499.31	0.35188	0.00161	0.82058	0.8206	0.7034	0.5862	0.4691	0.3519
1	0	0	0	0	0	1	0	17,444.80	0.35390	0.00161	0.82058	0.8206	0.7039	0.5872	0.4706	0.3539
1	0	0	0	0	0	0	1	17,467.63	0.35305	0.00105	0.88314	0.8831	0.7506	0.6181	0.4856	0.3531
1	0	0	0	0	0	0	0	17,413.12	0.35507	0.00105	0.88314	0.8831	0.7511	0.6191	0.4871	0.3551

Risk Scenarios for 40% ML (1 ="Occur"; 0 ="No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	715.21	0.97351	0.00406	0.54908	0.5491	0.6552	0.7613	0.8674	0.9735
0	1	1	1	1	1	1	0	660.70	0.97553	0.00406	0.54908	0.5491	0.6557	0.7623	0.8689	0.9755
0	1	1	1	1	1	0	1	683.53	0.97468	0.00350	0.61164	0.6116	0.7024	0.7932	0.8839	0.9747
0	1	1	1	1	1	0	0	629.02	0.97670	0.00350	0.61164	0.6116	0.7029	0.7942	0.8854	0.9767
0	1	1	1	1	0	1	1	644.67	0.97612	0.00406	0.54908	0.5491	0.6558	0.7626	0.8694	0.9761
0	1	1	1	1	0	1	0	590.16	0.97814	0.00406	0.54908	0.5491	0.6563	0.7636	0.8709	0.9781
0	1	1	1	1	0	0	1	612.99	0.97730	0.00350	0.61164	0.6116	0.7031	0.7945	0.8859	0.9773
0	1	1	1	1	0	0	0	558.48	0.97932	0.00350	0.61164	0.6116	0.7036	0.7955	0.8874	0.9793
0	1	1	1	0	1	1	1	592.74	0.97805	0.00403	0.55219	0.5522	0.6587	0.7651	0.8716	0.9780
0	1	1	1	0	1	1	0	538.23	0.98007	0.00403	0.55219	0.5522	0.6592	0.7661	0.8731	0.9801
0	1	1	1	0	1	0	1	561.06	0.97922	0.00347	0.61475	0.6147	0.7059	0.7970	0.8881	0.9792
0	1	1	1	0	1	0	0	506.55	0.98124	0.00347	0.61475	0.6147	0.7064	0.7980	0.8896	0.9812
0	1	1	1	0	0	1	1	522.21	0.98066	0.00403	0.55219	0.5522	0.6593	0.7664	0.8735	0.9807
0	1	1	1	0	0	1	0	467.69	0.98268	0.00403	0.55219	0.5522	0.6598	0.7674	0.8751	0.9827
0	1	1	1	0	0	0	1	490.53	0.98183	0.00347	0.61475	0.6147	0.7065	0.7983	0.8901	0.9818
0	1	1	1	0	0	0	0	436.01	0.98385	0.00347	0.61475	0.6147	0.7070	0.7993	0.8916	0.9839
0	1	1	0	1	1	1	1	665.01	0.97537	0.00406	0.54908	0.5491	0.6557	0.7622	0.8688	0.9754
0	1	1	0	1	1	1	0	610.50	0.97739	0.00406	0.54908	0.5491	0.6562	0.7632	0.8703	0.9774
0	1	1	0	1	1	0	1	633.33	0.97654	0.00350	0.61164	0.6116	0.7029	0.7941	0.8853	0.9765
0	1	1	0	1	1	0	0	578.82	0.97856	0.00350	0.61164	0.6116	0.7034	0.7951	0.8868	0.9786
0	1	1	0	1	0	1	1	594.48	0.97798	0.00406	0.54908	0.5491	0.6563	0.7635	0.8708	0.9780
0	1	1	0	1	0	1	0	539.97	0.98000	0.00406	0.54908	0.5491	0.6568	0.7645	0.8723	0.9800
0	1	1	0	1	0	0	1	562.80	0.97916	0.00350	0.61164	0.6116	0.7035	0.7954	0.8873	0.9792
0	1	1	0	1	0	0	0	508.29	0.98117	0.00350	0.61164	0.6116	0.7040	0.7964	0.8888	0.9812
0	1	1	0	0	1	1	1	542.54	0.97991	0.00403	0.55219	0.5522	0.6591	0.7660	0.8730	0.9799
0	1	1	0	0	1	1	0	488.03	0.98192	0.00403	0.55219	0.5522	0.6596	0.7671	0.8745	0.9819
0	1	1	0	0	1	0	1	510.86	0.98108	0.00347	0.61475	0.6147	0.7063	0.7979	0.8895	0.9811
0	1	1	0	0	1	0	0	456.35	0.98310	0.00347	0.61475	0.6147	0.7068	0.7989	0.8910	0.9831
0	1	1	0	0	0	1	1	472.01	0.98252	0.00403	0.55219	0.5522	0.6598	0.7674	0.8749	0.9825
0	1	1	0	0	0	1	0	417.50	0.98454	0.00403	0.55219	0.5522	0.6603	0.7684	0.8764	0.9845
0	1	1	0	0	0	0	1	440.33	0.98369	0.00347	0.61475	0.6147	0.7070	0.7992	0.8915	0.9837
0	1	1	0	0	0	0	0	385.82	0.98571	0.00347	0.61475	0.6147	0.7075	0.8002	0.8930	0.9857
0	1	0	1	1	1	1	1	517.73	0.98082	0.00059	0.93433	0.9343	0.9460	0.9576	0.9692	0.9808
0	1	0	1	1	1	1	0	463.22	0.98284	0.00059	0.93433	0.9343	0.9465	0.9586	0.9707	0.9828
0	1	0	1	1	1	0	1	486.05	0.98200	0.00003	0.99689	0.9969	0.9932	0.9894	0.9857	0.9820
0	1	0	1	1	1	0	0	431.54	0.98402	0.00003	0.99689	0.9969	0.9937	0.9905	0.9872	0.9840
0	1	0	1	1	0	1	1	447.20	0.98344	0.00059	0.93433	0.9343	0.9466	0.9589	0.9712	0.9834
0	1	0	1	1	0	1	0	392.68	0.98546	0.00059	0.93433	0.9343	0.9471	0.9599	0.9727	0.9855
0	1	0	1	1	0	0	1	415.52	0.98461	0.00003	0.99689	0.9969	0.9938	0.9908	0.9877	0.9846
0	1	0	1	1	0	0	0	361.00	0.98663	0.00003	0.99689	0.9969	0.9943	0.9918	0.9892	0.9866
0	1	0	1	0	1	1	1	395.26	0.98536	0.00056	0.93744	0.9374	0.9494	0.9614	0.9734	0.9854
0	1	0	1	0	1	1	0	340.75	0.98738	0.00056	0.93744	0.9374	0.9499	0.9624	0.9749	0.9874
0	1	0	1	0	1	0	1	363.58	0.98653	0.00000	1.00000	1.0000	0.9966	0.9933	0.9899	0.9865
0	1	0	1	0	1	0	0	309.07	0.98855	0.00000	1.00000	1.0000	0.9971	0.9943	0.9914	0.9886
0	1	0	1	0	0	1	1	324.73	0.98797	0.00056	0.93744	0.9374	0.9501	0.9627	0.9753	0.9880
0	1	0	1	0	0	1	0	270.21	0.98999	0.00056	0.93744	0.9374	0.9506	0.9637	0.9769	0.9900
0	1	0	1	0	0	0	1	293.05	0.98915	0.00000	1.00000	1.0000	0.9973	0.9946	0.9919	0.9891
0	1	0	1	0	0	0	0	238.53	0.99117	0.00000	1.00000	1.0000	0.9978	0.9956	0.9934	0.9912
0	1	0	0	1	1	1	1	467.53	0.98268	0.00059	0.93433	0.9343	0.9464	0.9585	0.9706	0.9827
0	1	0	0	1	1	1	0	413.02	0.98470	0.00059	0.93433	0.9343	0.9469	0.9595	0.9721	0.9847
0	1	0	0	1	1	0	1	435.85	0.98386	0.00003	0.99689	0.9969	0.9936	0.9904	0.9871	0.9839
0	1	0	0	1	1	0	0	381.34	0.98588	0.00003	0.99689	0.9969	0.9941	0.9914	0.9886	0.9859
0	1	0	0	1	0	1	1	397.00	0.98530	0.00059	0.93433	0.9343	0.9471	0.9598	0.9726	0.9853
0	1	0	0	1	0	1	0	342.49	0.98732	0.00059	0.93433	0.9343	0.9476	0.9608	0.9741	0.9873
0	1	0	0	1	0	0	1	365.32	0.98647	0.00003	0.99689	0.9969	0.9943	0.9917	0.9891	0.9865
0	1	0	0	1	0	0	0	310.81	0.98849	0.00003	0.99689	0.9969	0.9948	0.9927	0.9906	0.9885
0	1	0	0	0	1	1	1	345.06	0.98722	0.00056	0.93744	0.9374	0.9499	0.9623	0.9748	0.9872
0	1	0	0	0	1	1	0	290.55	0.98924	0.00056	0.93744	0.9374	0.9504	0.9633	0.9763	0.9892
0	1	0	0	0	1	0	1	313.38	0.98839	0.00000	1.00000	1.0000	0.9971	0.9942	0.9913	0.9884
0	1	0	0	0	1	0	0	258.87	0.99041	0.00000	1.00000	1.0000	0.9976	0.9952	0.9928	0.9904
0	1	0	0	0	0	1	1	274.53	0.98983	0.00056	0.93744	0.9374	0.9505	0.9636	0.9767	0.9898
0	1	0	0	0	0	1	0	220.02	0.99185	0.00056	0.93744	0.9374	0.9510	0.9646	0.9782	0.9919
0	1	0	0	0	0	0	1	242.85	0.99101	0.00000	1.00000	1.0000	0.9978	0.9955	0.9933	0.9910
0	1	0	0	0	0	0	0	188.34	0.99302	0.00000	1.00000	1.0000	0.9983	0.9965	0.9948	0.9930

Risk Scenarios for 40% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	526.87	0.98049	0.00406	0.54908	0.5491	0.6569	0.7648	0.8726	0.9805
0	0	1	1	1	1	1	0	472.36	0.98251	0.00406	0.54908	0.5491	0.6574	0.7658	0.8741	0.9825
0	0	1	1	1	1	0	1	495.19	0.98166	0.00350	0.61164	0.6116	0.7041	0.7967	0.8892	0.9817
0	0	1	1	1	1	0	0	440.68	0.98368	0.00350	0.61164	0.6116	0.7047	0.7977	0.8907	0.9837
0	0	1	1	1	0	1	1	456.34	0.98310	0.00406	0.54908	0.5491	0.6576	0.7661	0.8746	0.9831
0	0	1	1	1	0	1	0	401.83	0.98512	0.00406	0.54908	0.5491	0.6581	0.7671	0.8761	0.9851
0	0	1	1	1	0	0	1	424.66	0.98427	0.00350	0.61164	0.6116	0.7048	0.7980	0.8911	0.9843
0	0	1	1	1	0	0	0	370.15	0.98629	0.00350	0.61164	0.6116	0.7053	0.7990	0.8926	0.9863
0	0	1	1	0	1	1	1	404.40	0.98502	0.00403	0.55219	0.5522	0.6604	0.7686	0.8768	0.9850
0	0	1	1	0	1	1	0	349.89	0.98704	0.00403	0.55219	0.5522	0.6609	0.7696	0.8783	0.9870
0	0	1	1	0	1	0	1	372.72	0.98620	0.00347	0.61475	0.6147	0.7076	0.8005	0.8933	0.9862
0	0	1	1	0	1	0	0	318.21	0.98821	0.00347	0.61475	0.6147	0.7081	0.8015	0.8948	0.9882
0	0	1	1	0	0	1	1	333.87	0.98763	0.00403	0.55219	0.5522	0.6610	0.7699	0.8788	0.9876
0	0	1	1	0	0	1	0	279.36	0.98965	0.00403	0.55219	0.5522	0.6616	0.7709	0.8803	0.9897
0	0	1	1	0	0	0	1	302.19	0.98881	0.00347	0.61475	0.6147	0.7083	0.8018	0.8953	0.9888
0	0	1	1	0	0	0	0	247.68	0.99083	0.00347	0.61475	0.6147	0.7088	0.8028	0.8968	0.9908
0	0	1	0	1	1	1	1	476.67	0.98235	0.00406	0.54908	0.5491	0.6574	0.7657	0.8740	0.9823
0	0	1	0	1	1	1	0	422.16	0.98436	0.00406	0.54908	0.5491	0.6579	0.7667	0.8755	0.9844
0	0	1	0	1	1	0	1	444.99	0.98352	0.00350	0.61164	0.6116	0.7046	0.7976	0.8905	0.9835
0	0	1	0	1	1	0	0	390.48	0.98554	0.00350	0.61164	0.6116	0.7051	0.7986	0.8921	0.9855
0	0	1	0	1	0	1	1	406.14	0.98496	0.00406	0.54908	0.5491	0.6581	0.7670	0.8760	0.9850
0	0	1	0	1	0	1	0	351.63	0.98698	0.00406	0.54908	0.5491	0.6586	0.7680	0.8775	0.9870
0	0	1	0	1	0	0	1	374.46	0.98613	0.00350	0.61164	0.6116	0.7053	0.7989	0.8925	0.9861
0	0	1	0	1	0	0	0	319.95	0.98815	0.00350	0.61164	0.6116	0.7058	0.7999	0.8940	0.9882
0	0	1	0	0	1	1	1	354.20	0.98688	0.00403	0.55219	0.5522	0.6609	0.7695	0.8782	0.9869
0	0	1	0	0	1	1	0	299.69	0.98890	0.00403	0.55219	0.5522	0.6614	0.7705	0.8797	0.9889
0	0	1	0	0	1	0	1	322.52	0.98805	0.00347	0.61475	0.6147	0.7081	0.8014	0.8947	0.9881
0	0	1	0	0	1	0	0	268.01	0.99007	0.00347	0.61475	0.6147	0.7086	0.8024	0.8962	0.9901
0	0	1	0	0	0	1	1	283.67	0.98949	0.00403	0.55219	0.5522	0.6615	0.7708	0.8802	0.9895
0	0	1	0	0	0	1	0	229.16	0.99151	0.00403	0.55219	0.5522	0.6620	0.7719	0.8817	0.9915
0	0	1	0	0	0	0	1	251.99	0.99067	0.00347	0.61475	0.6147	0.7087	0.8027	0.8967	0.9907
0	0	1	0	0	0	0	0	197.48	0.99269	0.00347	0.61475	0.6147	0.7092	0.8037	0.8982	0.9927
0	0	0	1	1	1	1	1	329.39	0.98780	0.00059	0.93433	0.9343	0.9477	0.9611	0.9744	0.9878
0	0	0	1	1	1	1	0	274.88	0.98982	0.00059	0.93433	0.9343	0.9482	0.9621	0.9759	0.9898
0	0	0	1	1	1	0	1	297.71	0.98897	0.00003	0.99689	0.9969	0.9949	0.9929	0.9910	0.9890
0	0	0	1	1	1	0	0	243.20	0.99099	0.00003	0.99689	0.9969	0.9954	0.9939	0.9925	0.9910
0	0	0	1	1	0	1	1	258.86	0.99041	0.00059	0.93433	0.9343	0.9484	0.9624	0.9764	0.9904
0	0	0	1	1	0	1	0	204.35	0.99243	0.00059	0.93433	0.9343	0.9489	0.9634	0.9779	0.9924
0	0	0	1	1	0	0	1	227.18	0.99159	0.00003	0.99689	0.9969	0.9956	0.9942	0.9929	0.9916
0	0	0	1	1	0	0	0	172.67	0.99360	0.00003	0.99689	0.9969	0.9961	0.9952	0.9944	0.9936
0	0	0	1	0	1	1	1	206.92	0.99234	0.00056	0.93744	0.9374	0.9512	0.9649	0.9786	0.9923
0	0	0	1	0	1	1	0	152.41	0.99436	0.00056	0.93744	0.9374	0.9517	0.9659	0.9801	0.9944
0	0	0	1	0	1	0	1	175.24	0.99351	0.00000	1.00000	1.0000	0.9984	0.9968	0.9951	0.9935
0	0	0	1	0	1	0	0	120.73	0.99553	0.00000	1.00000	1.0000	0.9989	0.9978	0.9966	0.9955
0	0	0	1	0	0	1	1	136.39	0.99495	0.00056	0.93744	0.9374	0.9518	0.9662	0.9806	0.9949
0	0	0	1	0	0	1	0	81.88	0.99697	0.00056	0.93744	0.9374	0.9523	0.9672	0.9821	0.9970
0	0	0	1	0	0	0	1	104.71	0.99612	0.00000	1.00000	1.0000	0.9990	0.9981	0.9971	0.9961
0	0	0	1	0	0	0	0	50.20	0.99814	0.00000	1.00000	1.0000	0.9995	0.9991	0.9986	0.9981
0	0	0	0	1	1	1	1	279.19	0.98966	0.00059	0.93433	0.9343	0.9482	0.9620	0.9758	0.9897
0	0	0	0	1	1	1	0	224.68	0.99168	0.00059	0.93433	0.9343	0.9487	0.9630	0.9773	0.9917
0	0	0	0	1	1	0	1	247.51	0.99083	0.00003	0.99689	0.9969	0.9954	0.9939	0.9923	0.9908
0	0	0	0	1	1	0	0	193.00	0.99285	0.00003	0.99689	0.9969	0.9959	0.9949	0.9939	0.9929
0	0	0	0	1	0	1	1	208.66	0.99227	0.00059	0.93433	0.9343	0.9488	0.9633	0.9778	0.9923
0	0	0	0	1	0	1	0	154.15	0.99429	0.00059	0.93433	0.9343	0.9493	0.9643	0.9793	0.9943
0	0	0	0	1	0	0	1	176.98	0.99345	0.00003	0.99689	0.9969	0.9960	0.9952	0.9943	0.9934
0	0	0	0	1	0	0	0	122.47	0.99546	0.00003	0.99689	0.9969	0.9965	0.9962	0.9958	0.9955
0	0	0	0	0	1	1	1	156.72	0.99420	0.00056	0.93744	0.9374	0.9516	0.9658	0.9800	0.9942
0	0	0	0	0	1	1	0	102.21	0.99621	0.00056	0.93744	0.9374	0.9521	0.9668	0.9815	0.9962
0	0	0	0	0	1	0	1	125.04	0.99537	0.00000	1.00000	1.0000	0.9988	0.9977	0.9965	0.9954
0	0	0	0	0	1	0	0	70.53	0.99739	0.00000	1.00000	1.0000	0.9993	0.9987	0.9980	0.9974
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 50% ML (1 ="Occur"; 0 ="No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	15,573.77	0.4232	0.0044	0.5119	0.5119	0.4897	0.4676	0.4454	0.4232
1	1	1	1	1	1	1	0	15,519.26	0.4252	0.0044	0.5119	0.5119	0.4902	0.4686	0.4469	0.4252
1	1	1	1	1	1	0	1	15,542.09	0.4244	0.0038	0.5745	0.5745	0.5370	0.4994	0.4619	0.4244
1	1	1	1	1	1	0	0	15,487.58	0.4264	0.0038	0.5745	0.5745	0.5375	0.5004	0.4634	0.4264
1	1	1	1	1	0	1	1	15,509.65	0.4256	0.0044	0.5119	0.5119	0.4903	0.4687	0.4472	0.4256
1	1	1	1	1	0	1	0	15,455.14	0.4276	0.0044	0.5119	0.5119	0.4908	0.4698	0.4487	0.4276
1	1	1	1	1	0	0	1	15,477.97	0.4267	0.0038	0.5745	0.5745	0.5375	0.5006	0.4637	0.4267
1	1	1	1	1	0	0	0	15,423.46	0.4288	0.0038	0.5745	0.5745	0.5381	0.5016	0.4652	0.4288
1	1	1	1	0	1	1	1	15,462.44	0.4273	0.0044	0.5141	0.5141	0.4924	0.4707	0.4490	0.4273
1	1	1	1	0	1	1	0	15,407.93	0.4293	0.0044	0.5141	0.5141	0.4929	0.4717	0.4505	0.4293
1	1	1	1	0	1	0	1	15,430.76	0.4285	0.0038	0.5767	0.5767	0.5396	0.5026	0.4655	0.4285
1	1	1	1	0	1	0	0	15,376.25	0.4305	0.0038	0.5767	0.5767	0.5402	0.5036	0.4671	0.4305
1	1	1	1	0	0	1	1	15,398.32	0.4297	0.0044	0.5141	0.5141	0.4930	0.4719	0.4508	0.4297
1	1	1	1	0	0	1	0	15,343.81	0.4317	0.0044	0.5141	0.5141	0.4935	0.4729	0.4523	0.4317
1	1	1	1	0	0	0	1	15,366.64	0.4309	0.0038	0.5767	0.5767	0.5402	0.5038	0.4673	0.4309
1	1	1	1	0	0	0	0	15,312.13	0.4329	0.0038	0.5767	0.5767	0.5407	0.5048	0.4688	0.4329
1	1	1	0	1	1	1	1	15,528.14	0.4249	0.0044	0.5119	0.5119	0.4902	0.4684	0.4466	0.4249
1	1	1	0	1	1	1	0	15,473.63	0.4269	0.0044	0.5119	0.5119	0.4907	0.4694	0.4482	0.4269
1	1	1	0	1	1	0	1	15,496.46	0.4261	0.0038	0.5745	0.5745	0.5374	0.5003	0.4632	0.4261
1	1	1	0	1	1	0	0	15,441.95	0.4281	0.0038	0.5745	0.5745	0.5379	0.5013	0.4647	0.4281
1	1	1	0	1	0	1	1	15,464.02	0.4273	0.0044	0.5119	0.5119	0.4908	0.4696	0.4484	0.4273
1	1	1	0	1	0	1	0	15,409.51	0.4293	0.0044	0.5119	0.5119	0.4913	0.4706	0.4499	0.4293
1	1	1	0	1	0	0	1	15,432.34	0.4284	0.0038	0.5745	0.5745	0.5380	0.5015	0.4649	0.4284
1	1	1	0	1	0	0	0	15,377.83	0.4305	0.0038	0.5745	0.5745	0.5385	0.5025	0.4665	0.4305
1	1	1	0	0	1	1	1	15,416.81	0.4290	0.0044	0.5141	0.5141	0.4929	0.4716	0.4503	0.4290
1	1	1	0	0	1	1	0	15,362.29	0.4310	0.0044	0.5141	0.5141	0.4934	0.4726	0.4518	0.4310
1	1	1	0	0	1	0	1	15,385.13	0.4302	0.0038	0.5767	0.5767	0.5401	0.5034	0.4668	0.4302
1	1	1	0	0	1	0	0	15,330.61	0.4322	0.0038	0.5767	0.5767	0.5406	0.5044	0.4683	0.4322
1	1	1	0	0	0	1	1	15,352.68	0.4314	0.0044	0.5141	0.5141	0.4935	0.4728	0.4521	0.4314
1	1	1	0	0	0	1	0	15,298.17	0.4334	0.0044	0.5141	0.5141	0.4940	0.4738	0.4536	0.4334
1	1	1	0	0	0	0	1	15,321.00	0.4326	0.0038	0.5767	0.5767	0.5407	0.5046	0.4686	0.4326
1	1	1	0	0	0	0	0	15,266.49	0.4346	0.0038	0.5767	0.5767	0.5412	0.5056	0.4701	0.4346
1	1	0	1	1	1	1	1	15,394.25	0.4298	0.0015	0.8330	0.8330	0.7322	0.6314	0.5306	0.4298
1	1	0	1	1	1	1	0	15,339.74	0.4319	0.0015	0.8330	0.8330	0.7327	0.6324	0.5321	0.4319
1	1	0	1	1	1	0	1	15,362.57	0.4310	0.0009	0.8955	0.8955	0.7794	0.6633	0.5471	0.4310
1	1	0	1	1	1	0	0	15,308.06	0.4330	0.0009	0.8955	0.8955	0.7799	0.6643	0.5487	0.4330
1	1	0	1	1	0	1	1	15,330.13	0.4322	0.0015	0.8330	0.8330	0.7328	0.6326	0.5324	0.4322
1	1	0	1	1	0	1	0	15,275.62	0.4342	0.0015	0.8330	0.8330	0.7333	0.6336	0.5339	0.4342
1	1	0	1	1	0	0	1	15,298.45	0.4334	0.0009	0.8955	0.8955	0.7800	0.6645	0.5489	0.4334
1	1	0	1	1	0	0	0	15,243.94	0.4354	0.0009	0.8955	0.8955	0.7805	0.6655	0.5504	0.4354
1	1	0	1	0	1	1	1	15,282.91	0.4340	0.0015	0.8352	0.8352	0.7349	0.6346	0.5343	0.4340
1	1	0	1	0	1	1	0	15,228.40	0.4360	0.0015	0.8352	0.8352	0.7354	0.6356	0.5358	0.4360
1	1	0	1	0	1	0	1	15,251.23	0.4351	0.0009	0.8977	0.8977	0.7821	0.6664	0.5508	0.4351
1	1	0	1	0	1	0	0	15,196.72	0.4372	0.0009	0.8977	0.8977	0.7826	0.6675	0.5523	0.4372
1	1	0	1	0	0	1	1	15,218.79	0.4363	0.0015	0.8352	0.8352	0.7355	0.6358	0.5361	0.4363
1	1	0	1	0	0	1	0	15,164.28	0.4384	0.0015	0.8352	0.8352	0.7360	0.6368	0.5376	0.4384
1	1	0	1	0	0	0	1	15,187.11	0.4375	0.0009	0.8977	0.8977	0.7827	0.6676	0.5526	0.4375
1	1	0	1	0	0	0	0	15,132.60	0.4395	0.0009	0.8977	0.8977	0.7832	0.6686	0.5541	0.4395
1	1	0	0	1	1	1	1	15,348.61	0.4315	0.0015	0.8330	0.8330	0.7326	0.6322	0.5319	0.4315
1	1	0	0	1	1	1	0	15,294.10	0.4336	0.0015	0.8330	0.8330	0.7331	0.6333	0.5334	0.4336
1	1	0	0	1	1	0	1	15,316.93	0.4327	0.0009	0.8955	0.8955	0.7798	0.6641	0.5484	0.4327
1	1	0	0	1	1	0	0	15,262.42	0.4347	0.0009	0.8955	0.8955	0.7803	0.6651	0.5499	0.4347
1	1	0	0	1	0	1	1	15,284.49	0.4339	0.0015	0.8330	0.8330	0.7332	0.6334	0.5337	0.4339
1	1	0	0	1	0	1	0	15,229.98	0.4359	0.0015	0.8330	0.8330	0.7337	0.6344	0.5352	0.4359
1	1	0	0	1	0	0	1	15,252.81	0.4351	0.0009	0.8955	0.8955	0.7804	0.6653	0.5502	0.4351
1	1	0	0	1	0	0	0	15,198.30	0.4371	0.0009	0.8955	0.8955	0.7809	0.6663	0.5517	0.4371
1	1	0	0	0	1	1	1	15,237.28	0.4357	0.0015	0.8352	0.8352	0.7353	0.6354	0.5355	0.4357
1	1	0	0	0	1	1	0	15,182.77	0.4377	0.0015	0.8352	0.8352	0.7358	0.6364	0.5371	0.4377
1	1	0	0	0	1	0	1	15,205.60	0.4368	0.0009	0.8977	0.8977	0.7825	0.6673	0.5521	0.4368
1	1	0	0	0	1	0	0	15,151.09	0.4388	0.0009	0.8977	0.8977	0.7830	0.6683	0.5536	0.4388
1	1	0	0	0	0	1	1	15,173.16	0.4380	0.0015	0.8352	0.8352	0.7359	0.6366	0.5373	0.4380
1	1	0	0	0	0	1	0	15,118.65	0.4401	0.0015	0.8352	0.8352	0.7364	0.6376	0.5388	0.4401
1	1	0	0	0	0	0	1	15,141.48	0.4392	0.0009	0.8977	0.8977	0.7831	0.6685	0.5538	0.4392
1	1	0	0	0	0	0	0	15,086.97	0.4412	0.0009	0.8977	0.8977	0.7836	0.6695	0.5554	0.4412

Risk Scenarios for 50% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	15,412.34	0.42917	0.00439	0.51192	0.5119	0.4912	0.4705	0.4499	0.4292
1	0	1	1	1	1	1	0	15,357.83	0.43119	0.00439	0.51192	0.5119	0.4917	0.4716	0.4514	0.4312
1	0	1	1	1	1	0	1	15,380.66	0.43035	0.00383	0.57448	0.5745	0.5384	0.5024	0.4664	0.4303
1	0	1	1	1	1	0	0	15,326.15	0.43236	0.00383	0.57448	0.5745	0.5390	0.5034	0.4679	0.4324
1	0	1	1	1	0	1	1	15,348.22	0.43155	0.00439	0.51192	0.5119	0.4918	0.4717	0.4516	0.4315
1	0	1	1	1	0	1	0	15,293.71	0.43357	0.00439	0.51192	0.5119	0.4923	0.4727	0.4532	0.4336
1	0	1	1	1	0	0	1	15,316.54	0.43272	0.00383	0.57448	0.5745	0.5390	0.5036	0.4682	0.4327
1	0	1	1	1	0	0	0	15,262.03	0.43474	0.00383	0.57448	0.5745	0.5395	0.5046	0.4697	0.4347
1	0	1	1	0	1	1	1	15,301.01	0.43330	0.00437	0.51414	0.5141	0.4939	0.4737	0.4535	0.4333
1	0	1	1	0	1	1	0	15,246.50	0.43531	0.00437	0.51414	0.5141	0.4944	0.4747	0.4550	0.4353
1	0	1	1	0	1	0	1	15,269.33	0.43447	0.00381	0.57670	0.5767	0.5411	0.5056	0.4700	0.4345
1	0	1	1	0	1	0	0	15,214.82	0.43649	0.00381	0.57670	0.5767	0.5416	0.5066	0.4715	0.4365
1	0	1	1	0	0	1	1	15,236.88	0.43567	0.00437	0.51414	0.5141	0.4945	0.4749	0.4553	0.4357
1	0	1	1	0	0	1	0	15,182.37	0.43769	0.00437	0.51414	0.5141	0.4950	0.4759	0.4568	0.4377
1	0	1	1	0	0	0	1	15,205.20	0.43684	0.00381	0.57670	0.5767	0.5417	0.5068	0.4718	0.4368
1	0	1	1	0	0	0	0	15,150.69	0.43886	0.00381	0.57670	0.5767	0.5422	0.5078	0.4733	0.4389
1	0	1	0	1	1	1	1	15,366.71	0.43086	0.00439	0.51192	0.5119	0.4917	0.4714	0.4511	0.4309
1	0	1	0	1	1	1	0	15,312.20	0.43288	0.00439	0.51192	0.5119	0.4922	0.4724	0.4526	0.4329
1	0	1	0	1	1	0	1	15,335.03	0.43204	0.00383	0.57448	0.5745	0.5389	0.5033	0.4676	0.4320
1	0	1	0	1	1	0	0	15,280.52	0.43405	0.00383	0.57448	0.5745	0.5394	0.5043	0.4692	0.4341
1	0	1	0	1	0	1	1	15,302.59	0.43324	0.00439	0.51192	0.5119	0.4923	0.4726	0.4529	0.4332
1	0	1	0	1	0	1	0	15,248.08	0.43526	0.00439	0.51192	0.5119	0.4928	0.4736	0.4544	0.4353
1	0	1	0	1	0	0	1	15,270.91	0.43441	0.00383	0.57448	0.5745	0.5395	0.5044	0.4694	0.4344
1	0	1	0	1	0	0	0	15,216.40	0.43643	0.00383	0.57448	0.5745	0.5400	0.5055	0.4709	0.4364
1	0	1	0	0	1	1	1	15,255.37	0.43499	0.00437	0.51414	0.5141	0.4944	0.4746	0.4548	0.4350
1	0	1	0	0	1	1	0	15,200.86	0.43701	0.00437	0.51414	0.5141	0.4949	0.4756	0.4563	0.4370
1	0	1	0	0	1	0	1	15,223.69	0.43616	0.00381	0.57670	0.5767	0.5416	0.5064	0.4713	0.4362
1	0	1	0	0	1	0	0	15,169.18	0.43818	0.00381	0.57670	0.5767	0.5421	0.5074	0.4728	0.4382
1	0	1	0	0	0	1	1	15,191.25	0.43736	0.00437	0.51414	0.5141	0.4949	0.4758	0.4566	0.4374
1	0	1	0	0	0	1	0	15,136.74	0.43938	0.00437	0.51414	0.5141	0.4955	0.4768	0.4581	0.4394
1	0	1	0	0	0	0	1	15,159.57	0.43853	0.00381	0.57670	0.5767	0.5422	0.5076	0.4731	0.4385
1	0	1	0	0	0	0	0	15,105.06	0.44055	0.00381	0.57670	0.5767	0.5427	0.5086	0.4746	0.4406
1	0	0	1	1	1	1	1	15,232.81	0.43582	0.00150	0.83297	0.8330	0.7337	0.6344	0.5351	0.4358
1	0	0	1	1	1	1	0	15,178.30	0.43784	0.00150	0.83297	0.8330	0.7342	0.6354	0.5366	0.4378
1	0	0	1	1	1	0	1	15,201.14	0.43699	0.00094	0.89553	0.8955	0.7809	0.6663	0.5516	0.4370
1	0	0	1	1	1	0	0	15,146.62	0.43901	0.00094	0.89553	0.8955	0.7814	0.6673	0.5531	0.4390
1	0	0	1	1	0	1	1	15,168.69	0.43820	0.00150	0.83297	0.8330	0.7343	0.6356	0.5369	0.4382
1	0	0	1	1	0	1	0	15,114.18	0.44022	0.00150	0.83297	0.8330	0.7348	0.6366	0.5384	0.4402
1	0	0	1	1	0	0	1	15,137.01	0.43937	0.00094	0.89553	0.8955	0.7815	0.6674	0.5534	0.4394
1	0	0	1	1	0	0	0	15,082.50	0.44139	0.00094	0.89553	0.8955	0.7820	0.6685	0.5549	0.4414
1	0	0	1	0	1	1	1	15,121.48	0.43995	0.00148	0.83518	0.8352	0.7364	0.6376	0.5388	0.4399
1	0	0	1	0	1	1	0	15,066.97	0.44196	0.00148	0.83518	0.8352	0.7369	0.6386	0.5403	0.4420
1	0	0	1	0	1	0	1	15,089.80	0.44112	0.00092	0.89774	0.8977	0.7836	0.6694	0.5553	0.4411
1	0	0	1	0	1	0	0	15,035.29	0.44314	0.00092	0.89774	0.8977	0.7841	0.6704	0.5568	0.4431
1	0	0	1	0	0	1	1	15,057.36	0.44232	0.00148	0.83518	0.8352	0.7370	0.6388	0.5405	0.4423
1	0	0	1	0	0	1	0	15,002.85	0.44434	0.00148	0.83518	0.8352	0.7375	0.6398	0.5421	0.4443
1	0	0	1	0	0	0	1	15,025.68	0.44349	0.00092	0.89774	0.8977	0.7842	0.6706	0.5571	0.4435
1	0	0	1	0	0	0	0	14,971.17	0.44551	0.00092	0.89774	0.8977	0.7847	0.6716	0.5586	0.4455
1	0	0	0	1	1	1	1	15,187.18	0.43751	0.00150	0.83297	0.8330	0.7341	0.6352	0.5364	0.4375
1	0	0	0	1	1	1	0	15,132.67	0.43953	0.00150	0.83297	0.8330	0.7346	0.6362	0.5379	0.4395
1	0	0	0	1	1	0	1	15,155.50	0.43869	0.00094	0.89553	0.8955	0.7813	0.6671	0.5529	0.4387
1	0	0	0	1	1	0	0	15,100.99	0.44070	0.00094	0.89553	0.8955	0.7818	0.6681	0.5544	0.4407
1	0	0	0	1	0	1	1	15,123.06	0.43989	0.00150	0.83297	0.8330	0.7347	0.6364	0.5382	0.4399
1	0	0	0	1	0	1	0	15,068.55	0.44191	0.00150	0.83297	0.8330	0.7352	0.6374	0.5397	0.4419
1	0	0	0	1	0	0	1	15,091.38	0.44106	0.00094	0.89553	0.8955	0.7819	0.6683	0.5547	0.4411
1	0	0	0	1	0	0	0	15,036.87	0.44308	0.00094	0.89553	0.8955	0.7824	0.6693	0.5562	0.4431
1	0	0	0	0	1	1	1	15,075.85	0.44164	0.00148	0.83518	0.8352	0.7368	0.6384	0.5400	0.4416
1	0	0	0	0	1	1	0	15,021.34	0.44365	0.00148	0.83518	0.8352	0.7373	0.6394	0.5415	0.4437
1	0	0	0	0	1	0	1	15,044.17	0.44281	0.00092	0.89774	0.8977	0.7840	0.6703	0.5565	0.4428
1	0	0	0	0	1	0	0	14,989.66	0.44483	0.00092	0.89774	0.8977	0.7845	0.6713	0.5581	0.4448
1	0	0	0	0	0	1	1	15,011.72	0.44401	0.00148	0.83518	0.8352	0.7374	0.6396	0.5418	0.4440
1	0	0	0	0	0	1	0	14,957.21	0.44603	0.00148	0.83518	0.8352	0.7379	0.6406	0.5433	0.4460
1	0	0	0	0	0	0	1	14,980.04	0.44518	0.00092	0.89774	0.8977	0.7846	0.6715	0.5583	0.4452
1	0	0	0	0	0	0	0	14,925.53	0.44720	0.00092	0.89774	0.8977	0.7851	0.6725	0.5598	0.4472

Risk Scenarios for 50% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{tol}	$v(X_{tol})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	648.24	0.97599	0.00347	0.61418	0.6142	0.7046	0.7951	0.8855	0.9760
0	1	1	1	1	1	1	0	593.73	0.97801	0.00347	0.61418	0.6142	0.7051	0.7961	0.8871	0.9780
0	1	1	1	1	1	0	1	616.56	0.97716	0.00291	0.67674	0.6767	0.7518	0.8270	0.9021	0.9772
0	1	1	1	1	1	0	0	562.05	0.97918	0.00291	0.67674	0.6767	0.7523	0.8280	0.9036	0.9792
0	1	1	1	1	0	1	1	584.12	0.97837	0.00347	0.61418	0.6142	0.7052	0.7963	0.8873	0.9784
0	1	1	1	1	0	1	0	529.61	0.98038	0.00347	0.61418	0.6142	0.7057	0.7973	0.8888	0.9804
0	1	1	1	1	0	0	1	552.44	0.97954	0.00291	0.67674	0.6767	0.7524	0.8281	0.9038	0.9795
0	1	1	1	1	0	0	0	497.93	0.98156	0.00291	0.67674	0.6767	0.7529	0.8291	0.9054	0.9816
0	1	1	1	0	1	1	1	536.91	0.98011	0.00345	0.61640	0.6164	0.7073	0.7983	0.8892	0.9801
0	1	1	1	0	1	1	0	482.39	0.98213	0.00345	0.61640	0.6164	0.7078	0.7993	0.8907	0.9821
0	1	1	1	0	1	0	1	505.23	0.98129	0.00289	0.67896	0.6790	0.7545	0.8301	0.9057	0.9813
0	1	1	1	0	1	0	0	450.71	0.98331	0.00289	0.67896	0.6790	0.7550	0.8311	0.9072	0.9833
0	1	1	1	0	0	1	1	472.78	0.98249	0.00345	0.61640	0.6164	0.7079	0.7994	0.8910	0.9825
0	1	1	1	0	0	1	0	418.27	0.98451	0.00345	0.61640	0.6164	0.7084	0.8005	0.8925	0.9845
0	1	1	1	0	0	0	1	441.10	0.98366	0.00289	0.67896	0.6790	0.7551	0.8313	0.9075	0.9837
0	1	1	1	0	0	0	0	386.59	0.98568	0.00289	0.67896	0.6790	0.7556	0.8323	0.9090	0.9857
0	1	1	0	1	1	1	1	602.61	0.97768	0.00347	0.61418	0.6142	0.7051	0.7959	0.8868	0.9777
0	1	1	0	1	1	1	0	548.10	0.97970	0.00347	0.61418	0.6142	0.7056	0.7969	0.8883	0.9797
0	1	1	0	1	1	0	1	570.93	0.97885	0.00291	0.67674	0.6767	0.7523	0.8278	0.9033	0.9789
0	1	1	0	1	1	0	0	516.42	0.98087	0.00291	0.67674	0.6767	0.7528	0.8288	0.9048	0.9809
0	1	1	0	1	0	1	1	538.49	0.98006	0.00347	0.61418	0.6142	0.7056	0.7971	0.8886	0.9801
0	1	1	0	1	0	1	0	483.98	0.98207	0.00347	0.61418	0.6142	0.7062	0.7981	0.8901	0.9821
0	1	1	0	1	0	0	1	506.81	0.98123	0.00291	0.67674	0.6767	0.7529	0.8290	0.9051	0.9812
0	1	1	0	1	0	0	0	452.30	0.98325	0.00291	0.67674	0.6767	0.7534	0.8300	0.9066	0.9832
0	1	1	0	0	1	1	1	491.27	0.98180	0.00345	0.61640	0.6164	0.7077	0.7991	0.8905	0.9818
0	1	1	0	0	1	1	0	436.76	0.98382	0.00345	0.61640	0.6164	0.7083	0.8001	0.8920	0.9838
0	1	1	0	0	1	0	1	459.59	0.98298	0.00289	0.67896	0.6790	0.7550	0.8310	0.9070	0.9830
0	1	1	0	0	1	0	0	405.08	0.98500	0.00289	0.67896	0.6790	0.7555	0.8320	0.9085	0.9850
0	1	1	0	0	0	1	1	427.15	0.98418	0.00345	0.61640	0.6164	0.7083	0.8003	0.8922	0.9842
0	1	1	0	0	0	1	0	372.64	0.98620	0.00345	0.61640	0.6164	0.7088	0.8013	0.8937	0.9862
0	1	1	0	0	0	0	1	395.47	0.98535	0.00289	0.67896	0.6790	0.7556	0.8322	0.9088	0.9854
0	1	1	0	0	0	0	0	340.96	0.98737	0.00289	0.67896	0.6790	0.7561	0.8332	0.9103	0.9874
0	1	0	1	1	1	1	1	468.71	0.98264	0.00058	0.93522	0.9352	0.9471	0.9589	0.9708	0.9826
0	1	0	1	1	1	1	0	414.20	0.98466	0.00058	0.93522	0.9352	0.9476	0.9599	0.9723	0.9847
0	1	0	1	1	1	0	1	437.03	0.98381	0.00002	0.99778	0.9978	0.9943	0.9908	0.9873	0.9838
0	1	0	1	1	1	0	0	382.52	0.98583	0.00002	0.99778	0.9978	0.9948	0.9918	0.9888	0.9858
0	1	0	1	1	0	1	1	404.59	0.98502	0.00058	0.93522	0.9352	0.9477	0.9601	0.9726	0.9850
0	1	0	1	1	0	1	0	350.08	0.98703	0.00058	0.93522	0.9352	0.9482	0.9611	0.9741	0.9870
0	1	0	1	1	0	0	1	372.91	0.98619	0.00002	0.99778	0.9978	0.9949	0.9920	0.9891	0.9862
0	1	0	1	1	0	0	0	318.40	0.98821	0.00002	0.99778	0.9978	0.9954	0.9930	0.9906	0.9882
0	1	0	1	0	1	1	1	357.38	0.98676	0.00056	0.93744	0.9374	0.9498	0.9621	0.9744	0.9868
0	1	0	1	0	1	1	0	302.87	0.98878	0.00056	0.93744	0.9374	0.9503	0.9631	0.9759	0.9888
0	1	0	1	0	1	0	1	325.70	0.98794	0.00000	1.00000	1.0000	0.9970	0.9940	0.9910	0.9879
0	1	0	1	0	1	0	0	271.19	0.98996	0.00000	1.00000	1.0000	0.9975	0.9950	0.9925	0.9900
0	1	0	1	0	0	1	1	293.26	0.98914	0.00056	0.93744	0.9374	0.9504	0.9633	0.9762	0.9891
0	1	0	1	0	0	1	0	238.75	0.99116	0.00056	0.93744	0.9374	0.9509	0.9643	0.9777	0.9912
0	1	0	1	0	0	0	1	261.58	0.99031	0.00000	1.00000	1.0000	0.9976	0.9952	0.9927	0.9903
0	1	0	1	0	0	0	0	207.07	0.99233	0.00000	1.00000	1.0000	0.9981	0.9962	0.9942	0.9923
0	1	0	0	1	1	1	1	423.08	0.98433	0.00058	0.93522	0.9352	0.9475	0.9598	0.9721	0.9843
0	1	0	0	1	1	1	0	368.57	0.98635	0.00058	0.93522	0.9352	0.9480	0.9608	0.9736	0.9863
0	1	0	0	1	1	0	1	391.40	0.98550	0.00002	0.99778	0.9978	0.9947	0.9916	0.9886	0.9855
0	1	0	0	1	1	0	0	336.89	0.98752	0.00002	0.99778	0.9978	0.9952	0.9927	0.9901	0.9875
0	1	0	0	1	0	1	1	358.96	0.98671	0.00058	0.93522	0.9352	0.9481	0.9610	0.9738	0.9867
0	1	0	0	1	0	1	0	304.45	0.98872	0.00058	0.93522	0.9352	0.9486	0.9620	0.9753	0.9887
0	1	0	0	1	0	0	1	327.28	0.98788	0.00002	0.99778	0.9978	0.9953	0.9928	0.9904	0.9879
0	1	0	0	1	0	0	0	272.77	0.98990	0.00002	0.99778	0.9978	0.9958	0.9938	0.9919	0.9899
0	1	0	0	0	1	1	1	311.75	0.98845	0.00056	0.93744	0.9374	0.9502	0.9629	0.9757	0.9885
0	1	0	0	0	1	1	0	257.23	0.99047	0.00056	0.93744	0.9374	0.9507	0.9640	0.9772	0.9905
0	1	0	0	0	1	0	1	280.07	0.98963	0.00000	1.00000	1.0000	0.9974	0.9948	0.9922	0.9896
0	1	0	0	0	1	0	0	225.55	0.99165	0.00000	1.00000	1.0000	0.9979	0.9958	0.9937	0.9916
0	1	0	0	0	0	1	1	247.62	0.99083	0.00056	0.93744	0.9374	0.9508	0.9641	0.9775	0.9908
0	1	0	0	0	0	1	0	193.11	0.99285	0.00056	0.93744	0.9374	0.9513	0.9651	0.9790	0.9928
0	1	0	0	0	0	0	1	215.94	0.99200	0.00000	1.00000	1.0000	0.9980	0.9960	0.9940	0.9920
0	1	0	0	0	0	0	0	161.43	0.99402	0.00000	1.00000	1.0000	0.9985	0.9970	0.9955	0.9940

Risk Scenarios for 50% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	486.81	0.98197	0.00347	0.61418	0.6142	0.7061	0.7981	0.8900	0.9820
0	0	1	1	1	1	1	0	432.30	0.98399	0.00347	0.61418	0.6142	0.7066	0.7991	0.8915	0.9840
0	0	1	1	1	1	0	1	455.13	0.98314	0.00291	0.67674	0.6767	0.7533	0.8299	0.9065	0.9831
0	0	1	1	1	1	0	0	400.62	0.98516	0.00291	0.67674	0.6767	0.7538	0.8310	0.9081	0.9852
0	0	1	1	1	0	1	1	422.69	0.98434	0.00347	0.61418	0.6142	0.7067	0.7993	0.8918	0.9843
0	0	1	1	1	0	1	0	368.18	0.98636	0.00347	0.61418	0.6142	0.7072	0.8003	0.8933	0.9864
0	0	1	1	1	0	0	1	391.01	0.98552	0.00291	0.67674	0.6767	0.7539	0.8311	0.9083	0.9855
0	0	1	1	1	0	0	0	336.50	0.98754	0.00291	0.67674	0.6767	0.7544	0.8321	0.9098	0.9875
0	0	1	1	0	1	1	1	375.47	0.98609	0.00345	0.61640	0.6164	0.7088	0.8012	0.8937	0.9861
0	0	1	1	0	1	1	0	320.96	0.98811	0.00345	0.61640	0.6164	0.7093	0.8023	0.8952	0.9881
0	0	1	1	0	1	0	1	343.79	0.98727	0.00289	0.67896	0.6790	0.7560	0.8331	0.9102	0.9873
0	0	1	1	0	1	0	0	289.28	0.98929	0.00289	0.67896	0.6790	0.7565	0.8341	0.9117	0.9893
0	0	1	1	0	0	1	1	311.35	0.98847	0.00345	0.61640	0.6164	0.7094	0.8024	0.8955	0.9885
0	0	1	1	0	0	1	0	256.84	0.99049	0.00345	0.61640	0.6164	0.7099	0.8034	0.8970	0.9905
0	0	1	1	0	0	0	1	279.67	0.98964	0.00289	0.67896	0.6790	0.7566	0.8343	0.9120	0.9896
0	0	1	1	0	0	0	0	225.16	0.99166	0.00289	0.67896	0.6790	0.7571	0.8353	0.9135	0.9917
0	0	1	0	1	1	1	1	441.18	0.98366	0.00347	0.61418	0.6142	0.7065	0.7989	0.8913	0.9837
0	0	1	0	1	1	1	0	386.66	0.98568	0.00347	0.61418	0.6142	0.7071	0.7999	0.8928	0.9857
0	0	1	0	1	1	0	1	409.50	0.98483	0.00291	0.67674	0.6767	0.7538	0.8308	0.9078	0.9848
0	0	1	0	1	1	0	0	354.98	0.98685	0.00291	0.67674	0.6767	0.7543	0.8318	0.9093	0.9869
0	0	1	0	1	0	1	1	377.05	0.98604	0.00347	0.61418	0.6142	0.7071	0.8001	0.8931	0.9860
0	0	1	0	1	0	1	0	322.54	0.98805	0.00347	0.61418	0.6142	0.7076	0.8011	0.8946	0.9881
0	0	1	0	1	0	0	1	345.37	0.98721	0.00291	0.67674	0.6767	0.7544	0.8320	0.9096	0.9872
0	0	1	0	1	0	0	0	290.86	0.98923	0.00291	0.67674	0.6767	0.7549	0.8330	0.9111	0.9892
0	0	1	0	0	1	1	1	329.84	0.98778	0.00345	0.61640	0.6164	0.7092	0.8021	0.8949	0.9878
0	0	1	0	0	1	1	0	275.33	0.98980	0.00345	0.61640	0.6164	0.7097	0.8031	0.8965	0.9898
0	0	1	0	0	1	0	1	298.16	0.98896	0.00289	0.67896	0.6790	0.7565	0.8340	0.9115	0.9890
0	0	1	0	0	1	0	0	243.65	0.99098	0.00289	0.67896	0.6790	0.7570	0.8350	0.9130	0.9910
0	0	1	0	0	0	1	1	265.72	0.99016	0.00345	0.61640	0.6164	0.7098	0.8033	0.8967	0.9902
0	0	1	0	0	0	1	0	211.21	0.99218	0.00345	0.61640	0.6164	0.7103	0.8043	0.8982	0.9922
0	0	1	0	0	0	0	1	234.04	0.99133	0.00289	0.67896	0.6790	0.7571	0.8351	0.9132	0.9913
0	0	1	0	0	0	0	0	179.53	0.99335	0.00289	0.67896	0.6790	0.7576	0.8362	0.9148	0.9934
0	0	0	1	1	1	1	1	307.28	0.98862	0.00058	0.93522	0.9352	0.9486	0.9619	0.9753	0.9886
0	0	0	1	1	1	1	0	252.77	0.99064	0.00058	0.93522	0.9352	0.9491	0.9629	0.9768	0.9906
0	0	0	1	1	1	0	1	275.60	0.98979	0.00002	0.99778	0.9978	0.9958	0.9938	0.9918	0.9898
0	0	0	1	1	1	0	0	221.09	0.99181	0.00002	0.99778	0.9978	0.9963	0.9948	0.9933	0.9918
0	0	0	1	1	0	1	1	243.16	0.99099	0.00058	0.93522	0.9352	0.9492	0.9631	0.9771	0.9910
0	0	0	1	1	0	1	0	188.65	0.99301	0.00058	0.93522	0.9352	0.9497	0.9641	0.9786	0.9930
0	0	0	1	1	0	0	1	211.48	0.99217	0.00002	0.99778	0.9978	0.9964	0.9950	0.9936	0.9922
0	0	0	1	1	0	0	0	156.97	0.99419	0.00002	0.99778	0.9978	0.9969	0.9960	0.9951	0.9942
0	0	0	1	0	1	1	1	195.95	0.99274	0.00056	0.93744	0.9374	0.9513	0.9651	0.9789	0.9927
0	0	0	1	0	1	1	0	141.43	0.99476	0.00056	0.93744	0.9374	0.9518	0.9661	0.9804	0.9948
0	0	0	1	0	1	0	1	164.27	0.99392	0.00000	1.00000	1.0000	0.9985	0.9970	0.9954	0.9939
0	0	0	1	0	1	0	0	109.75	0.99594	0.00000	1.00000	1.0000	0.9990	0.9980	0.9970	0.9959
0	0	0	1	0	0	1	1	131.82	0.99512	0.00056	0.93744	0.9374	0.9519	0.9663	0.9807	0.9951
0	0	0	1	0	0	1	0	77.31	0.99714	0.00056	0.93744	0.9374	0.9524	0.9673	0.9822	0.9971
0	0	0	1	0	0	0	1	100.14	0.99629	0.00000	1.00000	1.0000	0.9991	0.9981	0.9972	0.9963
0	0	0	1	0	0	0	0	45.63	0.99831	0.00000	1.00000	1.0000	0.9996	0.9992	0.9987	0.9983
0	0	0	0	1	1	1	1	261.65	0.99031	0.00058	0.93522	0.9352	0.9490	0.9628	0.9765	0.9903
0	0	0	0	1	1	1	0	207.14	0.99233	0.00058	0.93522	0.9352	0.9495	0.9638	0.9781	0.9923
0	0	0	0	1	1	0	1	229.97	0.99148	0.00002	0.99778	0.9978	0.9962	0.9946	0.9931	0.9915
0	0	0	0	1	1	0	0	175.46	0.99350	0.00002	0.99778	0.9978	0.9967	0.9956	0.9946	0.9935
0	0	0	0	1	0	1	1	197.53	0.99268	0.00058	0.93522	0.9352	0.9496	0.9640	0.9783	0.9927
0	0	0	0	1	0	1	0	143.02	0.99470	0.00058	0.93522	0.9352	0.9501	0.9650	0.9798	0.9947
0	0	0	0	1	0	0	1	165.85	0.99386	0.00002	0.99778	0.9978	0.9968	0.9958	0.9948	0.9939
0	0	0	0	1	0	0	0	111.34	0.99588	0.00002	0.99778	0.9978	0.9973	0.9968	0.9964	0.9959
0	0	0	0	0	1	1	1	150.31	0.99443	0.00056	0.93744	0.9374	0.9517	0.9659	0.9802	0.9944
0	0	0	0	0	1	1	0	95.80	0.99645	0.00056	0.93744	0.9374	0.9522	0.9669	0.9817	0.9965
0	0	0	0	0	1	0	1	118.63	0.99561	0.00000	1.00000	1.0000	0.9989	0.9978	0.9967	0.9956
0	0	0	0	0	1	0	0	64.12	0.99763	0.00000	1.00000	1.0000	0.9994	0.9988	0.9982	0.9976
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 60% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	13,059.28	0.5163	0.0043	0.5265	0.5265	0.5240	0.5214	0.5189	0.5163
1	1	1	1	1	1	1	0	13,004.77	0.5183	0.0043	0.5265	0.5265	0.5245	0.5224	0.5204	0.5183
1	1	1	1	1	1	0	1	13,027.60	0.5175	0.0037	0.5891	0.5891	0.5712	0.5533	0.5354	0.5175
1	1	1	1	1	1	0	0	12,973.09	0.5195	0.0037	0.5891	0.5891	0.5717	0.5543	0.5369	0.5195
1	1	1	1	1	0	1	1	12,995.16	0.5187	0.0043	0.5265	0.5265	0.5246	0.5226	0.5207	0.5187
1	1	1	1	1	0	1	0	12,940.65	0.5207	0.0043	0.5265	0.5265	0.5251	0.5236	0.5222	0.5207
1	1	1	1	1	0	0	1	12,963.48	0.5199	0.0037	0.5891	0.5891	0.5718	0.5545	0.5372	0.5199
1	1	1	1	1	0	0	0	12,908.97	0.5219	0.0037	0.5891	0.5891	0.5723	0.5555	0.5387	0.5219
1	1	1	1	0	1	1	1	12,947.94	0.5204	0.0042	0.5287	0.5287	0.5267	0.5246	0.5225	0.5204
1	1	1	1	0	1	1	0	12,893.43	0.5225	0.0042	0.5287	0.5287	0.5272	0.5256	0.5240	0.5225
1	1	1	1	0	1	0	1	12,916.26	0.5216	0.0037	0.5913	0.5913	0.5739	0.5565	0.5390	0.5216
1	1	1	1	0	1	0	0	12,861.75	0.5236	0.0037	0.5913	0.5913	0.5744	0.5575	0.5406	0.5236
1	1	1	1	0	0	1	1	12,883.82	0.5228	0.0042	0.5287	0.5287	0.5273	0.5258	0.5243	0.5228
1	1	1	1	0	0	1	0	12,829.31	0.5248	0.0042	0.5287	0.5287	0.5278	0.5268	0.5258	0.5248
1	1	1	1	0	0	0	1	12,852.14	0.5240	0.0037	0.5913	0.5913	0.5745	0.5577	0.5408	0.5240
1	1	1	1	0	0	0	0	12,797.63	0.5260	0.0037	0.5913	0.5913	0.5750	0.5587	0.5423	0.5260
1	1	1	0	1	1	1	1	13,013.65	0.5180	0.0043	0.5265	0.5265	0.5244	0.5223	0.5201	0.5180
1	1	1	0	1	1	1	0	12,959.14	0.5200	0.0043	0.5265	0.5265	0.5249	0.5233	0.5217	0.5200
1	1	1	0	1	1	0	1	12,981.97	0.5192	0.0037	0.5891	0.5891	0.5716	0.5541	0.5367	0.5192
1	1	1	0	1	1	0	0	12,927.46	0.5212	0.0037	0.5891	0.5891	0.5721	0.5551	0.5382	0.5212
1	1	1	0	1	0	1	1	12,949.53	0.5204	0.0043	0.5265	0.5265	0.5250	0.5235	0.5219	0.5204
1	1	1	0	1	0	1	0	12,895.01	0.5224	0.0043	0.5265	0.5265	0.5255	0.5245	0.5234	0.5224
1	1	1	0	1	0	0	1	12,917.85	0.5216	0.0037	0.5891	0.5891	0.5722	0.5553	0.5384	0.5216
1	1	1	0	1	0	0	0	12,863.33	0.5236	0.0037	0.5891	0.5891	0.5727	0.5563	0.5400	0.5236
1	1	1	0	0	1	1	1	12,902.31	0.5221	0.0042	0.5287	0.5287	0.5271	0.5254	0.5238	0.5221
1	1	1	0	0	1	1	0	12,847.80	0.5242	0.0042	0.5287	0.5287	0.5276	0.5265	0.5253	0.5242
1	1	1	0	0	1	0	1	12,870.63	0.5233	0.0037	0.5913	0.5913	0.5743	0.5573	0.5403	0.5233
1	1	1	0	0	1	0	0	12,816.12	0.5253	0.0037	0.5913	0.5913	0.5748	0.5583	0.5418	0.5253
1	1	1	0	0	0	1	1	12,838.19	0.5245	0.0042	0.5287	0.5287	0.5277	0.5266	0.5256	0.5245
1	1	1	0	0	0	1	0	12,783.68	0.5265	0.0042	0.5287	0.5287	0.5282	0.5276	0.5271	0.5265
1	1	1	0	0	0	0	1	12,806.51	0.5257	0.0037	0.5913	0.5913	0.5749	0.5585	0.5421	0.5257
1	1	1	0	0	0	0	0	12,752.00	0.5277	0.0037	0.5913	0.5913	0.5754	0.5595	0.5436	0.5277
1	1	0	1	1	1	1	1	12,879.75	0.5230	0.0014	0.8476	0.8476	0.7664	0.6853	0.6041	0.5230
1	1	0	1	1	1	1	0	12,825.24	0.5250	0.0014	0.8476	0.8476	0.7669	0.6863	0.6056	0.5250
1	1	0	1	1	1	0	1	12,848.07	0.5241	0.0008	0.9101	0.9101	0.8136	0.7171	0.6206	0.5241
1	1	0	1	1	1	0	0	12,793.56	0.5262	0.0008	0.9101	0.9101	0.8141	0.7181	0.6222	0.5262
1	1	0	1	1	0	1	1	12,815.63	0.5253	0.0014	0.8476	0.8476	0.7670	0.6865	0.6059	0.5253
1	1	0	1	1	0	1	0	12,761.12	0.5274	0.0014	0.8476	0.8476	0.7675	0.6875	0.6074	0.5274
1	1	0	1	1	0	0	1	12,783.95	0.5265	0.0008	0.9101	0.9101	0.8142	0.7183	0.6224	0.5265
1	1	0	1	1	0	0	0	12,729.44	0.5285	0.0008	0.9101	0.9101	0.8147	0.7193	0.6239	0.5285
1	1	0	1	0	1	1	1	12,768.42	0.5271	0.0014	0.8498	0.8498	0.7691	0.6884	0.6078	0.5271
1	1	0	1	0	1	1	0	12,713.91	0.5291	0.0014	0.8498	0.8498	0.7696	0.6895	0.6093	0.5291
1	1	0	1	0	1	0	1	12,736.74	0.5283	0.0008	0.9124	0.9124	0.8163	0.7203	0.6243	0.5283
1	1	0	1	0	1	0	0	12,682.23	0.5303	0.0008	0.9124	0.9124	0.8168	0.7213	0.6258	0.5303
1	1	0	1	0	0	1	1	12,704.30	0.5295	0.0014	0.8498	0.8498	0.7697	0.6896	0.6096	0.5295
1	1	0	1	0	0	1	0	12,649.79	0.5315	0.0014	0.8498	0.8498	0.7702	0.6906	0.6111	0.5315
1	1	0	1	0	0	0	1	12,672.62	0.5306	0.0008	0.9124	0.9124	0.8169	0.7215	0.6261	0.5306
1	1	0	1	0	0	0	0	12,618.11	0.5327	0.0008	0.9124	0.9124	0.8174	0.7225	0.6276	0.5327
1	1	0	0	1	1	1	1	12,834.12	0.5247	0.0014	0.8476	0.8476	0.7668	0.6861	0.6054	0.5247
1	1	0	0	1	1	1	0	12,779.61	0.5267	0.0014	0.8476	0.8476	0.7674	0.6871	0.6069	0.5267
1	1	0	0	1	1	0	1	12,802.44	0.5258	0.0008	0.9101	0.9101	0.8141	0.7180	0.6219	0.5258
1	1	0	0	1	1	0	0	12,747.93	0.5279	0.0008	0.9101	0.9101	0.8146	0.7190	0.6234	0.5279
1	1	0	0	1	0	1	1	12,770.00	0.5270	0.0014	0.8476	0.8476	0.7674	0.6873	0.6072	0.5270
1	1	0	0	1	0	1	0	12,715.49	0.5291	0.0014	0.8476	0.8476	0.7679	0.6883	0.6087	0.5291
1	1	0	0	1	0	0	1	12,738.32	0.5282	0.0008	0.9101	0.9101	0.8147	0.7192	0.6237	0.5282
1	1	0	0	1	0	0	0	12,683.81	0.5302	0.0008	0.9101	0.9101	0.8152	0.7202	0.6252	0.5302
1	1	0	0	0	1	1	1	12,722.78	0.5288	0.0014	0.8498	0.8498	0.7695	0.6893	0.6090	0.5288
1	1	0	0	0	1	1	0	12,668.27	0.5308	0.0014	0.8498	0.8498	0.7700	0.6903	0.6106	0.5308
1	1	0	0	0	1	0	1	12,691.10	0.5300	0.0008	0.9124	0.9124	0.8168	0.7212	0.6256	0.5300
1	1	0	0	0	1	0	0	12,636.59	0.5320	0.0008	0.9124	0.9124	0.8173	0.7222	0.6271	0.5320
1	1	0	0	0	0	1	1	12,658.66	0.5312	0.0014	0.8498	0.8498	0.7701	0.6905	0.6108	0.5312
1	1	0	0	0	0	1	0	12,604.15	0.5332	0.0014	0.8498	0.8498	0.7706	0.6915	0.6123	0.5332
1	1	0	0	0	0	0	1	12,626.98	0.5323	0.0008	0.9124	0.9124	0.8173	0.7223	0.6273	0.5323
1	1	0	0	0	0	0	0	12,572.47	0.5344	0.0008	0.9124	0.9124	0.8179	0.7234	0.6289	0.5344

Risk Scenarios for 60% ML (1 = "Occur"; 0 = "No")								Single Consequence Data				w_{TC} = 0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	12,924.75	0.52131	0.00426	0.52653	0.5265	0.5252	0.5239	0.5226	0.5213
1	0	1	1	1	1	1	0	12,870.24	0.52332	0.00426	0.52653	0.5265	0.5257	0.5249	0.5241	0.5233
1	0	1	1	1	1	0	1	12,893.07	0.52248	0.00370	0.58909	0.5891	0.5724	0.5558	0.5391	0.5225
1	0	1	1	1	1	0	0	12,838.56	0.52450	0.00370	0.58909	0.5891	0.5729	0.5568	0.5406	0.5245
1	0	1	1	1	0	1	1	12,860.63	0.52368	0.00426	0.52653	0.5265	0.5258	0.5251	0.5244	0.5237
1	0	1	1	1	0	1	0	12,806.12	0.52570	0.00426	0.52653	0.5265	0.5263	0.5261	0.5259	0.5257
1	0	1	1	1	0	0	1	12,828.95	0.52485	0.00370	0.58909	0.5891	0.5730	0.5570	0.5409	0.5249
1	0	1	1	1	0	0	0	12,774.44	0.52687	0.00370	0.58909	0.5891	0.5735	0.5580	0.5424	0.5269
1	0	1	1	0	1	1	1	12,813.42	0.52543	0.00424	0.52875	0.5287	0.5279	0.5271	0.5263	0.5254
1	0	1	1	0	1	1	0	12,758.91	0.52745	0.00424	0.52875	0.5287	0.5284	0.5281	0.5278	0.5274
1	0	1	1	0	1	0	1	12,781.74	0.52660	0.00368	0.59131	0.5913	0.5751	0.5590	0.5428	0.5266
1	0	1	1	0	1	0	0	12,727.23	0.52862	0.00368	0.59131	0.5913	0.5756	0.5600	0.5443	0.5286
1	0	1	1	0	0	1	1	12,749.30	0.52780	0.00424	0.52875	0.5287	0.5285	0.5283	0.5280	0.5278
1	0	1	1	0	0	1	0	12,694.78	0.52982	0.00424	0.52875	0.5287	0.5290	0.5293	0.5296	0.5298
1	0	1	1	0	0	0	1	12,717.62	0.52898	0.00368	0.59131	0.5913	0.5757	0.5601	0.5446	0.5290
1	0	1	1	0	0	0	0	12,663.10	0.53100	0.00368	0.59131	0.5913	0.5762	0.5612	0.5461	0.5310
1	0	1	0	1	1	1	1	12,879.12	0.52300	0.00426	0.52653	0.5265	0.5256	0.5248	0.5239	0.5230
1	0	1	0	1	1	1	0	12,824.61	0.52501	0.00426	0.52653	0.5265	0.5262	0.5258	0.5254	0.5250
1	0	1	0	1	1	0	1	12,847.44	0.52417	0.00370	0.58909	0.5891	0.5729	0.5566	0.5404	0.5242
1	0	1	0	1	1	0	0	12,792.93	0.52619	0.00370	0.58909	0.5891	0.5734	0.5576	0.5419	0.5262
1	0	1	0	1	0	1	1	12,815.00	0.52537	0.00426	0.52653	0.5265	0.5262	0.5260	0.5257	0.5254
1	0	1	0	1	0	1	0	12,760.49	0.52739	0.00426	0.52653	0.5265	0.5267	0.5270	0.5272	0.5274
1	0	1	0	1	0	0	1	12,783.32	0.52654	0.00370	0.58909	0.5891	0.5735	0.5578	0.5422	0.5265
1	0	1	0	1	0	0	0	12,728.81	0.52856	0.00370	0.58909	0.5891	0.5740	0.5588	0.5437	0.5286
1	0	1	0	0	1	1	1	12,767.78	0.52712	0.00424	0.52875	0.5287	0.5283	0.5279	0.5275	0.5271
1	0	1	0	0	1	1	0	12,713.27	0.52914	0.00424	0.52875	0.5287	0.5288	0.5289	0.5290	0.5291
1	0	1	0	0	1	0	1	12,736.10	0.52829	0.00368	0.59131	0.5913	0.5756	0.5598	0.5440	0.5283
1	0	1	0	0	1	0	0	12,681.59	0.53031	0.00368	0.59131	0.5913	0.5761	0.5608	0.5456	0.5303
1	0	1	0	0	0	1	1	12,703.66	0.52949	0.00424	0.52875	0.5287	0.5289	0.5291	0.5293	0.5295
1	0	1	0	0	0	1	0	12,649.15	0.53151	0.00424	0.52875	0.5287	0.5294	0.5301	0.5308	0.5315
1	0	1	0	0	0	0	1	12,671.98	0.53067	0.00368	0.59131	0.5913	0.5761	0.5610	0.5458	0.5307
1	0	1	0	0	0	0	0	12,617.47	0.53269	0.00368	0.59131	0.5913	0.5767	0.5620	0.5473	0.5327
1	0	0	1	1	1	1	1	12,745.23	0.52795	0.00137	0.84757	0.8476	0.7677	0.6878	0.6079	0.5280
1	0	0	1	1	1	1	0	12,690.71	0.52997	0.00137	0.84757	0.8476	0.7682	0.6888	0.6094	0.5300
1	0	0	1	1	1	0	1	12,713.55	0.52913	0.00081	0.91013	0.9101	0.8149	0.7196	0.6244	0.5291
1	0	0	1	1	1	0	0	12,659.03	0.53115	0.00081	0.91013	0.9101	0.8154	0.7206	0.6259	0.5311
1	0	0	1	1	0	1	1	12,681.10	0.53033	0.00137	0.84757	0.8476	0.7683	0.6890	0.6096	0.5303
1	0	0	1	1	0	1	0	12,626.59	0.53235	0.00137	0.84757	0.8476	0.7688	0.6900	0.6112	0.5323
1	0	0	1	1	0	0	1	12,649.42	0.53150	0.00081	0.91013	0.9101	0.8155	0.7208	0.6262	0.5315
1	0	0	1	1	0	0	0	12,594.91	0.53352	0.00081	0.91013	0.9101	0.8160	0.7218	0.6277	0.5335
1	0	0	1	0	1	1	1	12,633.89	0.53208	0.00135	0.84979	0.8498	0.7704	0.6909	0.6115	0.5321
1	0	0	1	0	1	1	0	12,579.38	0.53410	0.00135	0.84979	0.8498	0.7709	0.6919	0.6130	0.5341
1	0	0	1	0	1	0	1	12,602.21	0.53325	0.00079	0.91235	0.9124	0.8176	0.7228	0.6280	0.5333
1	0	0	1	0	1	0	0	12,547.70	0.53527	0.00079	0.91235	0.9124	0.8181	0.7238	0.6295	0.5353
1	0	0	1	0	0	1	1	12,569.77	0.53445	0.00135	0.84979	0.8498	0.7710	0.6921	0.6133	0.5345
1	0	0	1	0	0	1	0	12,515.26	0.53647	0.00135	0.84979	0.8498	0.7715	0.6931	0.6148	0.5365
1	0	0	1	0	0	0	1	12,538.09	0.53563	0.00079	0.91235	0.9124	0.8182	0.7240	0.6298	0.5356
1	0	0	1	0	0	0	0	12,483.58	0.53765	0.00079	0.91235	0.9124	0.8187	0.7250	0.6313	0.5376
1	0	0	0	1	1	1	1	12,699.59	0.52964	0.00137	0.84757	0.8476	0.7681	0.6886	0.6091	0.5296
1	0	0	0	1	1	1	0	12,645.08	0.53166	0.00137	0.84757	0.8476	0.7686	0.6896	0.6106	0.5317
1	0	0	0	1	1	0	1	12,667.91	0.53082	0.00081	0.91013	0.9101	0.8153	0.7205	0.6256	0.5308
1	0	0	0	1	1	0	0	12,613.40	0.53284	0.00081	0.91013	0.9101	0.8158	0.7215	0.6272	0.5328
1	0	0	0	1	0	1	1	12,635.47	0.53202	0.00137	0.84757	0.8476	0.7687	0.6898	0.6109	0.5320
1	0	0	0	1	0	1	0	12,580.96	0.53404	0.00137	0.84757	0.8476	0.7692	0.6908	0.6124	0.5340
1	0	0	0	1	0	0	1	12,603.79	0.53319	0.00081	0.91013	0.9101	0.8159	0.7217	0.6274	0.5332
1	0	0	0	1	0	0	0	12,549.28	0.53521	0.00081	0.91013	0.9101	0.8164	0.7227	0.6289	0.5352
1	0	0	0	0	1	1	1	12,588.26	0.53377	0.00135	0.84979	0.8498	0.7708	0.6918	0.6128	0.5338
1	0	0	0	0	1	1	0	12,533.75	0.53579	0.00135	0.84979	0.8498	0.7713	0.6928	0.6143	0.5358
1	0	0	0	0	1	0	1	12,556.58	0.53494	0.00079	0.91235	0.9124	0.8180	0.7236	0.6293	0.5349
1	0	0	0	0	1	0	0	12,502.07	0.53696	0.00079	0.91235	0.9124	0.8185	0.7247	0.6308	0.5370
1	0	0	0	0	0	1	1	12,524.14	0.53614	0.00135	0.84979	0.8498	0.7714	0.6930	0.6146	0.5361
1	0	0	0	0	0	1	0	12,469.62	0.53816	0.00135	0.84979	0.8498	0.7719	0.6940	0.6161	0.5382
1	0	0	0	0	0	0	1	12,492.46	0.53732	0.00079	0.91235	0.9124	0.8186	0.7248	0.6311	0.5373
1	0	0	0	0	0	0	0	12,437.94	0.53934	0.00079	0.91235	0.9124	0.8191	0.7258	0.6326	0.5393

Risk Scenarios for 60% ML (1 ="Occur"; 0 ="No")								Single Consequence Data				w_{TC} = 0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	621.34	0.97699	0.00347	0.61418	0.6142	0.7049	0.7956	0.8863	0.9770
0	1	1	1	1	1	1	0	566.82	0.97901	0.00347	0.61418	0.6142	0.7054	0.7966	0.8878	0.9790
0	1	1	1	1	1	0	1	589.66	0.97816	0.00291	0.67674	0.6767	0.7521	0.8274	0.9028	0.9782
0	1	1	1	1	1	0	0	535.14	0.98018	0.00291	0.67674	0.6767	0.7526	0.8285	0.9043	0.9802
0	1	1	1	1	0	1	1	557.21	0.97936	0.00347	0.61418	0.6142	0.7055	0.7968	0.8881	0.9794
0	1	1	1	1	0	1	0	502.70	0.98138	0.00347	0.61418	0.6142	0.7060	0.7978	0.8896	0.9814
0	1	1	1	1	0	0	1	525.53	0.98054	0.00291	0.67674	0.6767	0.7527	0.8286	0.9046	0.9805
0	1	1	1	1	0	0	0	471.02	0.98255	0.00291	0.67674	0.6767	0.7532	0.8296	0.9061	0.9826
0	1	1	1	0	1	1	1	510.00	0.98111	0.00345	0.61640	0.6164	0.7076	0.7988	0.8899	0.9811
0	1	1	1	0	1	1	0	455.49	0.98313	0.00345	0.61640	0.6164	0.7081	0.7998	0.8914	0.9831
0	1	1	1	0	1	0	1	478.32	0.98228	0.00289	0.67896	0.6790	0.7548	0.8306	0.9065	0.9823
0	1	1	1	0	1	0	0	423.81	0.98430	0.00289	0.67896	0.6790	0.7553	0.8316	0.9080	0.9843
0	1	1	1	0	0	1	1	445.88	0.98349	0.00345	0.61640	0.6164	0.7082	0.7999	0.8917	0.9835
0	1	1	1	0	0	1	0	391.37	0.98550	0.00345	0.61640	0.6164	0.7087	0.8010	0.8932	0.9855
0	1	1	1	0	0	0	1	414.20	0.98466	0.00289	0.67896	0.6790	0.7554	0.8318	0.9082	0.9847
0	1	1	1	0	0	0	0	359.69	0.98668	0.00289	0.67896	0.6790	0.7559	0.8328	0.9097	0.9867
0	1	1	0	1	1	1	1	575.70	0.97868	0.00347	0.61418	0.6142	0.7053	0.7964	0.8876	0.9787
0	1	1	0	1	1	1	0	521.19	0.98070	0.00347	0.61418	0.6142	0.7058	0.7974	0.8891	0.9807
0	1	1	0	1	1	0	1	544.02	0.97985	0.00291	0.67674	0.6767	0.7525	0.8283	0.9041	0.9799
0	1	1	0	1	1	0	0	489.51	0.98187	0.00291	0.67674	0.6767	0.7530	0.8293	0.9056	0.9819
0	1	1	0	1	0	1	1	511.58	0.98105	0.00347	0.61418	0.6142	0.7059	0.7976	0.8893	0.9811
0	1	1	0	1	0	1	0	457.07	0.98307	0.00347	0.61418	0.6142	0.7064	0.7986	0.8908	0.9831
0	1	1	0	1	0	0	1	479.90	0.98223	0.00291	0.67674	0.6767	0.7531	0.8295	0.9059	0.9822
0	1	1	0	1	0	0	0	425.39	0.98424	0.00291	0.67674	0.6767	0.7536	0.8305	0.9074	0.9842
0	1	1	0	0	1	1	1	464.37	0.98280	0.00345	0.61640	0.6164	0.7080	0.7996	0.8912	0.9828
0	1	1	0	0	1	1	0	409.86	0.98482	0.00345	0.61640	0.6164	0.7085	0.8006	0.8927	0.9848
0	1	1	0	0	1	0	1	432.69	0.98397	0.00289	0.67896	0.6790	0.7552	0.8315	0.9077	0.9840
0	1	1	0	0	1	0	0	378.18	0.98599	0.00289	0.67896	0.6790	0.7557	0.8325	0.9092	0.9860
0	1	1	0	0	0	1	1	400.25	0.98518	0.00345	0.61640	0.6164	0.7086	0.8008	0.8930	0.9852
0	1	1	0	0	0	1	0	345.73	0.98720	0.00345	0.61640	0.6164	0.7091	0.8018	0.8945	0.9872
0	1	1	0	0	0	0	1	368.57	0.98635	0.00289	0.67896	0.6790	0.7558	0.8327	0.9095	0.9863
0	1	1	0	0	0	0	0	314.05	0.98837	0.00289	0.67896	0.6790	0.7563	0.8337	0.9110	0.9884
0	1	0	1	1	1	1	1	441.81	0.98364	0.00058	0.93522	0.9352	0.9473	0.9594	0.9715	0.9836
0	1	0	1	1	1	1	0	387.30	0.98566	0.00058	0.93522	0.9352	0.9478	0.9604	0.9730	0.9857
0	1	0	1	1	1	0	1	410.13	0.98481	0.00002	0.99778	0.9978	0.9945	0.9913	0.9881	0.9848
0	1	0	1	1	1	0	0	355.62	0.98683	0.00002	0.99778	0.9978	0.9950	0.9923	0.9896	0.9868
0	1	0	1	1	0	1	1	377.69	0.98601	0.00058	0.93522	0.9352	0.9479	0.9606	0.9733	0.9860
0	1	0	1	1	0	1	0	323.18	0.98803	0.00058	0.93522	0.9352	0.9484	0.9616	0.9748	0.9880
0	1	0	1	1	0	0	1	346.01	0.98718	0.00002	0.99778	0.9978	0.9951	0.9925	0.9898	0.9872
0	1	0	1	1	0	0	0	291.50	0.98920	0.00002	0.99778	0.9978	0.9956	0.9935	0.9913	0.9892
0	1	0	1	0	1	1	1	330.47	0.98776	0.00056	0.93744	0.9374	0.9500	0.9626	0.9752	0.9878
0	1	0	1	0	1	1	0	275.96	0.98978	0.00056	0.93744	0.9374	0.9505	0.9636	0.9767	0.9898
0	1	0	1	0	1	0	1	298.79	0.98893	0.00000	1.00000	1.0000	0.9972	0.9945	0.9917	0.9889
0	1	0	1	0	1	0	0	244.28	0.99095	0.00000	1.00000	1.0000	0.9977	0.9955	0.9932	0.9910
0	1	0	1	0	0	1	1	266.35	0.99014	0.00056	0.93744	0.9374	0.9506	0.9638	0.9770	0.9901
0	1	0	1	0	0	1	0	211.84	0.99215	0.00056	0.93744	0.9374	0.9511	0.9648	0.9785	0.9922
0	1	0	1	0	0	0	1	234.67	0.99131	0.00000	1.00000	1.0000	0.9978	0.9957	0.9935	0.9913
0	1	0	1	0	0	0	0	180.16	0.99333	0.00000	1.00000	1.0000	0.9983	0.9967	0.9950	0.9933
0	1	0	0	1	1	1	1	396.18	0.98533	0.00058	0.93522	0.9352	0.9477	0.9603	0.9728	0.9853
0	1	0	0	1	1	1	0	341.66	0.98735	0.00058	0.93522	0.9352	0.9483	0.9613	0.9743	0.9873
0	1	0	0	1	1	0	1	364.50	0.98650	0.00002	0.99778	0.9978	0.9950	0.9921	0.9893	0.9865
0	1	0	0	1	1	0	0	309.98	0.98852	0.00002	0.99778	0.9978	0.9955	0.9932	0.9908	0.9885
0	1	0	0	1	0	1	1	332.05	0.98770	0.00058	0.93522	0.9352	0.9483	0.9615	0.9746	0.9877
0	1	0	0	1	0	1	0	277.54	0.98972	0.00058	0.93522	0.9352	0.9488	0.9625	0.9761	0.9897
0	1	0	0	1	0	0	1	300.37	0.98888	0.00002	0.99778	0.9978	0.9956	0.9933	0.9911	0.9889
0	1	0	0	1	0	0	0	245.86	0.99089	0.00002	0.99778	0.9978	0.9961	0.9943	0.9926	0.9909
0	1	0	0	0	1	1	1	284.84	0.98945	0.00056	0.93744	0.9374	0.9504	0.9634	0.9764	0.9895
0	1	0	0	0	1	1	0	230.33	0.99147	0.00056	0.93744	0.9374	0.9509	0.9645	0.9780	0.9915
0	1	0	0	0	1	0	1	253.16	0.99062	0.00000	1.00000	1.0000	0.9977	0.9953	0.9930	0.9906
0	1	0	0	0	1	0	0	198.65	0.99264	0.00000	1.00000	1.0000	0.9982	0.9963	0.9945	0.9926
0	1	0	0	0	0	1	1	220.72	0.99183	0.00056	0.93744	0.9374	0.9510	0.9646	0.9782	0.9918
0	1	0	0	0	0	1	0	166.21	0.99384	0.00056	0.93744	0.9374	0.9515	0.9656	0.9797	0.9938
0	1	0	0	0	0	0	1	189.04	0.99300	0.00000	1.00000	1.0000	0.9982	0.9965	0.9947	0.9930
0	1	0	0	0	0	0	0	134.53	0.99502	0.00000	1.00000	1.0000	0.9988	0.9975	0.9963	0.9950

Risk Scenarios for 60% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	486.81	0.98197	0.00347	0.61418	0.6142	0.7061	0.7981	0.8900	0.9820
0	0	1	1	1	1	1	0	432.30	0.98399	0.00347	0.61418	0.6142	0.7066	0.7991	0.8915	0.9840
0	0	1	1	1	1	0	1	455.13	0.98314	0.00291	0.67674	0.6767	0.7533	0.8299	0.9065	0.9831
0	0	1	1	1	1	0	0	400.62	0.98516	0.00291	0.67674	0.6767	0.7538	0.8310	0.9081	0.9852
0	0	1	1	1	0	1	1	422.69	0.98434	0.00347	0.61418	0.6142	0.7067	0.7993	0.8918	0.9843
0	0	1	1	1	0	1	0	368.18	0.98636	0.00347	0.61418	0.6142	0.7072	0.8003	0.8933	0.9864
0	0	1	1	1	0	0	1	391.01	0.98552	0.00291	0.67674	0.6767	0.7539	0.8311	0.9083	0.9855
0	0	1	1	1	0	0	0	336.50	0.98754	0.00291	0.67674	0.6767	0.7544	0.8321	0.9098	0.9875
0	0	1	1	0	1	1	1	375.47	0.98609	0.00345	0.61640	0.6164	0.7088	0.8012	0.8937	0.9861
0	0	1	1	0	1	1	0	320.96	0.98811	0.00345	0.61640	0.6164	0.7093	0.8023	0.8952	0.9881
0	0	1	1	0	1	0	1	343.79	0.98727	0.00289	0.67896	0.6790	0.7560	0.8331	0.9102	0.9873
0	0	1	1	0	1	0	0	289.28	0.98929	0.00289	0.67896	0.6790	0.7565	0.8341	0.9117	0.9893
0	0	1	1	0	0	1	1	311.35	0.98847	0.00345	0.61640	0.6164	0.7094	0.8024	0.8955	0.9885
0	0	1	1	0	0	1	0	256.84	0.99049	0.00345	0.61640	0.6164	0.7099	0.8034	0.8970	0.9905
0	0	1	1	0	0	0	1	279.67	0.98964	0.00289	0.67896	0.6790	0.7566	0.8343	0.9120	0.9896
0	0	1	1	0	0	0	0	225.16	0.99166	0.00289	0.67896	0.6790	0.7571	0.8353	0.9135	0.9917
0	0	1	0	1	1	1	1	441.18	0.98366	0.00347	0.61418	0.6142	0.7065	0.7989	0.8913	0.9837
0	0	1	0	1	1	1	0	386.66	0.98568	0.00347	0.61418	0.6142	0.7071	0.7999	0.8928	0.9857
0	0	1	0	1	1	0	1	409.50	0.98483	0.00291	0.67674	0.6767	0.7538	0.8308	0.9078	0.9848
0	0	1	0	1	1	0	0	354.98	0.98685	0.00291	0.67674	0.6767	0.7543	0.8318	0.9093	0.9869
0	0	1	0	1	0	1	1	377.05	0.98604	0.00347	0.61418	0.6142	0.7071	0.8001	0.8931	0.9860
0	0	1	0	1	0	1	0	322.54	0.98805	0.00347	0.61418	0.6142	0.7076	0.8011	0.8946	0.9881
0	0	1	0	1	0	0	1	345.37	0.98721	0.00291	0.67674	0.6767	0.7544	0.8320	0.9096	0.9872
0	0	1	0	1	0	0	0	290.86	0.98923	0.00291	0.67674	0.6767	0.7549	0.8330	0.9111	0.9892
0	0	1	0	0	1	1	1	329.84	0.98778	0.00345	0.61640	0.6164	0.7092	0.8021	0.8949	0.9878
0	0	1	0	0	1	1	0	275.33	0.98980	0.00345	0.61640	0.6164	0.7097	0.8031	0.8965	0.9898
0	0	1	0	0	1	0	1	298.16	0.98896	0.00289	0.67896	0.6790	0.7565	0.8340	0.9115	0.9890
0	0	1	0	0	1	0	0	243.65	0.99098	0.00289	0.67896	0.6790	0.7570	0.8350	0.9130	0.9910
0	0	1	0	0	0	1	1	265.72	0.99016	0.00345	0.61640	0.6164	0.7098	0.8033	0.8967	0.9902
0	0	1	0	0	0	1	0	211.21	0.99218	0.00345	0.61640	0.6164	0.7103	0.8043	0.8982	0.9922
0	0	1	0	0	0	0	1	234.04	0.99133	0.00289	0.67896	0.6790	0.7571	0.8351	0.9132	0.9913
0	0	1	0	0	0	0	0	179.53	0.99335	0.00289	0.67896	0.6790	0.7576	0.8362	0.9148	0.9934
0	0	0	1	1	1	1	1	307.28	0.98862	0.00058	0.93522	0.9352	0.9486	0.9619	0.9753	0.9886
0	0	0	1	1	1	1	0	252.77	0.99064	0.00058	0.93522	0.9352	0.9491	0.9629	0.9768	0.9906
0	0	0	1	1	1	0	1	275.60	0.98979	0.00002	0.99778	0.9978	0.9958	0.9938	0.9918	0.9898
0	0	0	1	1	1	0	0	221.09	0.99181	0.00002	0.99778	0.9978	0.9963	0.9948	0.9933	0.9918
0	0	0	1	1	0	1	1	243.16	0.99099	0.00058	0.93522	0.9352	0.9492	0.9631	0.9771	0.9910
0	0	0	1	1	0	1	0	188.65	0.99301	0.00058	0.93522	0.9352	0.9497	0.9641	0.9786	0.9930
0	0	0	1	1	0	0	1	211.48	0.99217	0.00002	0.99778	0.9978	0.9964	0.9950	0.9936	0.9922
0	0	0	1	1	0	0	0	156.97	0.99419	0.00002	0.99778	0.9978	0.9969	0.9960	0.9951	0.9942
0	0	0	1	0	1	1	1	195.95	0.99274	0.00056	0.93744	0.9374	0.9513	0.9651	0.9789	0.9927
0	0	0	1	0	1	1	0	141.43	0.99476	0.00056	0.93744	0.9374	0.9518	0.9661	0.9804	0.9948
0	0	0	1	0	1	0	1	164.27	0.99392	0.00000	1.00000	1.0000	0.9985	0.9970	0.9954	0.9939
0	0	0	1	0	1	0	0	109.75	0.99594	0.00000	1.00000	1.0000	0.9990	0.9980	0.9970	0.9959
0	0	0	1	0	0	1	1	131.82	0.99512	0.00056	0.93744	0.9374	0.9519	0.9663	0.9807	0.9951
0	0	0	1	0	0	1	0	77.31	0.99714	0.00056	0.93744	0.9374	0.9524	0.9673	0.9822	0.9971
0	0	0	1	0	0	0	1	100.14	0.99629	0.00000	1.00000	1.0000	0.9991	0.9981	0.9972	0.9963
0	0	0	1	0	0	0	0	45.63	0.99831	0.00000	1.00000	1.0000	0.9996	0.9992	0.9987	0.9983
0	0	0	0	1	1	1	1	261.65	0.99031	0.00058	0.93522	0.9352	0.9490	0.9628	0.9765	0.9903
0	0	0	0	1	1	1	0	207.14	0.99233	0.00058	0.93522	0.9352	0.9495	0.9638	0.9781	0.9923
0	0	0	0	1	1	0	1	229.97	0.99148	0.00002	0.99778	0.9978	0.9962	0.9946	0.9931	0.9915
0	0	0	0	1	1	0	0	175.46	0.99350	0.00002	0.99778	0.9978	0.9967	0.9956	0.9946	0.9935
0	0	0	0	1	0	1	1	197.53	0.99268	0.00058	0.93522	0.9352	0.9496	0.9640	0.9783	0.9927
0	0	0	0	1	0	1	0	143.02	0.99470	0.00058	0.93522	0.9352	0.9501	0.9650	0.9798	0.9947
0	0	0	0	1	0	0	1	165.85	0.99386	0.00002	0.99778	0.9978	0.9968	0.9958	0.9948	0.9939
0	0	0	0	1	0	0	0	111.34	0.99588	0.00002	0.99778	0.9978	0.9973	0.9968	0.9964	0.9959
0	0	0	0	0	1	1	1	150.31	0.99443	0.00056	0.93744	0.9374	0.9517	0.9659	0.9802	0.9944
0	0	0	0	0	1	1	0	95.80	0.99645	0.00056	0.93744	0.9374	0.9522	0.9669	0.9817	0.9965
0	0	0	0	0	1	0	1	118.63	0.99561	0.00000	1.00000	1.0000	0.9989	0.9978	0.9967	0.9956
0	0	0	0	0	1	0	0	64.12	0.99763	0.00000	1.00000	1.0000	0.9994	0.9988	0.9982	0.9976
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Risk Scenarios for 70-100% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	1	1	1	1	1	1	1	13,059.28	0.5163	0.0041	0.5411	0.5411	0.5349	0.5287	0.5225	0.5163
1	1	1	1	1	1	1	0	13,004.77	0.5183	0.0041	0.5411	0.5411	0.5354	0.5297	0.5240	0.5183
1	1	1	1	1	1	0	1	13,027.60	0.5175	0.0036	0.6037	0.6037	0.5821	0.5606	0.5390	0.5175
1	1	1	1	1	1	0	0	12,973.09	0.5195	0.0036	0.6037	0.6037	0.5827	0.5616	0.5406	0.5195
1	1	1	1	1	0	1	1	12,995.16	0.5187	0.0041	0.5411	0.5411	0.5355	0.5299	0.5243	0.5187
1	1	1	1	1	0	1	0	12,940.65	0.5207	0.0041	0.5411	0.5411	0.5360	0.5309	0.5258	0.5207
1	1	1	1	1	0	0	1	12,963.48	0.5199	0.0036	0.6037	0.6037	0.5827	0.5618	0.5408	0.5199
1	1	1	1	1	0	0	0	12,908.97	0.5219	0.0036	0.6037	0.6037	0.5832	0.5628	0.5423	0.5219
1	1	1	1	0	1	1	1	12,947.94	0.5204	0.0041	0.5434	0.5434	0.5376	0.5319	0.5262	0.5204
1	1	1	1	0	1	1	0	12,893.43	0.5225	0.0041	0.5434	0.5434	0.5381	0.5329	0.5277	0.5225
1	1	1	1	0	1	0	1	12,916.26	0.5216	0.0035	0.6059	0.6059	0.5848	0.5638	0.5427	0.5216
1	1	1	1	0	1	0	0	12,861.75	0.5236	0.0035	0.6059	0.6059	0.5853	0.5648	0.5442	0.5236
1	1	1	1	0	0	1	1	12,883.82	0.5228	0.0041	0.5434	0.5434	0.5382	0.5331	0.5280	0.5228
1	1	1	1	0	0	1	0	12,829.31	0.5248	0.0041	0.5434	0.5434	0.5387	0.5341	0.5295	0.5248
1	1	1	1	0	0	0	1	12,852.14	0.5240	0.0035	0.6059	0.6059	0.5854	0.5650	0.5445	0.5240
1	1	1	1	0	0	0	0	12,797.63	0.5260	0.0035	0.6059	0.6059	0.5859	0.5660	0.5460	0.5260
1	1	1	0	1	1	1	1	13,013.65	0.5180	0.0041	0.5411	0.5411	0.5354	0.5296	0.5238	0.5180
1	1	1	0	1	1	1	0	12,959.14	0.5200	0.0041	0.5411	0.5411	0.5359	0.5306	0.5253	0.5200
1	1	1	0	1	1	0	1	12,981.97	0.5192	0.0036	0.6037	0.6037	0.5826	0.5614	0.5403	0.5192
1	1	1	0	1	1	0	0	12,927.46	0.5212	0.0036	0.6037	0.6037	0.5831	0.5625	0.5418	0.5212
1	1	1	0	1	0	1	1	12,949.53	0.5204	0.0041	0.5411	0.5411	0.5360	0.5308	0.5256	0.5204
1	1	1	0	1	0	1	0	12,895.01	0.5224	0.0041	0.5411	0.5411	0.5365	0.5318	0.5271	0.5224
1	1	1	0	1	0	0	1	12,917.85	0.5216	0.0036	0.6037	0.6037	0.5832	0.5626	0.5421	0.5216
1	1	1	0	1	0	0	0	12,863.33	0.5236	0.0036	0.6037	0.6037	0.5837	0.5636	0.5436	0.5236
1	1	1	0	0	1	1	1	12,902.31	0.5221	0.0041	0.5434	0.5434	0.5381	0.5327	0.5274	0.5221
1	1	1	0	0	1	1	0	12,847.80	0.5242	0.0041	0.5434	0.5434	0.5386	0.5338	0.5290	0.5242
1	1	1	0	0	1	0	1	12,870.63	0.5233	0.0035	0.6059	0.6059	0.5853	0.5646	0.5440	0.5233
1	1	1	0	0	1	0	0	12,816.12	0.5253	0.0035	0.6059	0.6059	0.5858	0.5656	0.5455	0.5253
1	1	1	0	0	0	1	1	12,838.19	0.5245	0.0041	0.5434	0.5434	0.5386	0.5339	0.5292	0.5245
1	1	1	0	0	0	1	0	12,783.68	0.5265	0.0041	0.5434	0.5434	0.5392	0.5349	0.5307	0.5265
1	1	1	0	0	0	0	1	12,806.51	0.5257	0.0035	0.6059	0.6059	0.5859	0.5658	0.5457	0.5257
1	1	1	0	0	0	0	0	12,752.00	0.5277	0.0035	0.6059	0.6059	0.5864	0.5668	0.5473	0.5277
1	1	0	1	1	1	1	1	12,879.75	0.5230	0.0012	0.8622	0.8622	0.7774	0.6926	0.6078	0.5230
1	1	0	1	1	1	1	0	12,825.24	0.5250	0.0012	0.8622	0.8622	0.7779	0.6936	0.6093	0.5250
1	1	0	1	1	1	0	1	12,848.07	0.5241	0.0007	0.9247	0.9247	0.8246	0.7244	0.6243	0.5241
1	1	0	1	1	1	0	0	12,793.56	0.5262	0.0007	0.9247	0.9247	0.8251	0.7255	0.6258	0.5262
1	1	0	1	1	0	1	1	12,815.63	0.5253	0.0012	0.8622	0.8622	0.7780	0.6938	0.6096	0.5253
1	1	0	1	1	0	1	0	12,761.12	0.5274	0.0012	0.8622	0.8622	0.7785	0.6948	0.6111	0.5274
1	1	0	1	1	0	0	1	12,783.95	0.5265	0.0007	0.9247	0.9247	0.8252	0.7256	0.6261	0.5265
1	1	0	1	1	0	0	0	12,729.44	0.5285	0.0007	0.9247	0.9247	0.8257	0.7266	0.6276	0.5285
1	1	0	1	0	1	1	1	12,768.42	0.5271	0.0012	0.8644	0.8644	0.7801	0.6957	0.6114	0.5271
1	1	0	1	0	1	1	0	12,713.91	0.5291	0.0012	0.8644	0.8644	0.7806	0.6968	0.6129	0.5291
1	1	0	1	0	1	0	1	12,736.74	0.5283	0.0007	0.9270	0.9270	0.8273	0.7276	0.6279	0.5283
1	1	0	1	0	1	0	0	12,682.23	0.5303	0.0007	0.9270	0.9270	0.8278	0.7286	0.6295	0.5303
1	1	0	1	0	0	1	1	12,704.30	0.5295	0.0012	0.8644	0.8644	0.7807	0.6969	0.6132	0.5295
1	1	0	1	0	0	1	0	12,649.79	0.5315	0.0012	0.8644	0.8644	0.7812	0.6979	0.6147	0.5315
1	1	0	1	0	0	0	1	12,672.62	0.5306	0.0007	0.9270	0.9270	0.8279	0.7288	0.6297	0.5306
1	1	0	1	0	0	0	0	12,618.11	0.5327	0.0007	0.9270	0.9270	0.8284	0.7298	0.6312	0.5327
1	1	0	0	1	1	1	1	12,834.12	0.5247	0.0012	0.8622	0.8622	0.7778	0.6934	0.6090	0.5247
1	1	0	0	1	1	1	0	12,779.61	0.5267	0.0012	0.8622	0.8622	0.7783	0.6944	0.6106	0.5267
1	1	0	0	1	1	0	1	12,802.44	0.5258	0.0007	0.9247	0.9247	0.8250	0.7253	0.6256	0.5258
1	1	0	0	1	1	0	0	12,747.93	0.5279	0.0007	0.9247	0.9247	0.8255	0.7263	0.6271	0.5279
1	1	0	0	1	0	1	1	12,770.00	0.5270	0.0012	0.8622	0.8622	0.7784	0.6946	0.6108	0.5270
1	1	0	0	1	0	1	0	12,715.49	0.5291	0.0012	0.8622	0.8622	0.7789	0.6956	0.6123	0.5291
1	1	0	0	1	0	0	1	12,738.32	0.5282	0.0007	0.9247	0.9247	0.8256	0.7265	0.6273	0.5282
1	1	0	0	1	0	0	0	12,683.81	0.5302	0.0007	0.9247	0.9247	0.8261	0.7275	0.6289	0.5302
1	1	0	0	0	1	1	1	12,722.78	0.5288	0.0012	0.8644	0.8644	0.7805	0.6966	0.6127	0.5288
1	1	0	0	0	1	1	0	12,668.27	0.5308	0.0012	0.8644	0.8644	0.7810	0.6976	0.6142	0.5308
1	1	0	0	0	1	0	1	12,691.10	0.5300	0.0007	0.9270	0.9270	0.8277	0.7285	0.6292	0.5300
1	1	0	0	0	1	0	0	12,636.59	0.5320	0.0007	0.9270	0.9270	0.8282	0.7295	0.6307	0.5320
1	1	0	0	0	0	1	1	12,658.66	0.5312	0.0012	0.8644	0.8644	0.7811	0.6978	0.6145	0.5312
1	1	0	0	0	0	1	0	12,604.15	0.5332	0.0012	0.8644	0.8644	0.7816	0.6988	0.6160	0.5332
1	1	0	0	0	0	0	1	12,626.98	0.5323	0.0007	0.9270	0.9270	0.8283	0.7296	0.6310	0.5323
1	1	0	0	0	0	0	0	12,572.47	0.5344	0.0007	0.9270	0.9270	0.8288	0.7307	0.6325	0.5344

Risk Scenarios for 70-100% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
1	0	1	1	1	1	1	1	12,924.75	0.52131	0.00413	0.54114	0.5411	0.5362	0.5312	0.5263	0.5213
1	0	1	1	1	1	1	0	12,870.24	0.52332	0.00413	0.54114	0.5411	0.5367	0.5322	0.5278	0.5233
1	0	1	1	1	1	0	1	12,893.07	0.52248	0.00357	0.60370	0.6037	0.5834	0.5631	0.5428	0.5225
1	0	1	1	1	1	0	0	12,838.56	0.52450	0.00357	0.60370	0.6037	0.5839	0.5641	0.5443	0.5245
1	0	1	1	1	0	1	1	12,860.63	0.52368	0.00413	0.54114	0.5411	0.5368	0.5324	0.5280	0.5237
1	0	1	1	1	0	1	0	12,806.12	0.52570	0.00413	0.54114	0.5411	0.5373	0.5334	0.5296	0.5257
1	0	1	1	1	0	0	1	12,828.95	0.52485	0.00357	0.60370	0.6037	0.5840	0.5643	0.5446	0.5249
1	0	1	1	1	0	0	0	12,774.44	0.52687	0.00357	0.60370	0.6037	0.5845	0.5653	0.5461	0.5269
1	0	1	1	0	1	1	1	12,813.42	0.52543	0.00411	0.54336	0.5434	0.5389	0.5344	0.5299	0.5254
1	0	1	1	0	1	1	0	12,758.91	0.52745	0.00411	0.54336	0.5434	0.5394	0.5354	0.5314	0.5274
1	0	1	1	0	1	0	1	12,781.74	0.52660	0.00355	0.60592	0.6059	0.5861	0.5663	0.5464	0.5266
1	0	1	1	0	1	0	0	12,727.23	0.52862	0.00355	0.60592	0.6059	0.5866	0.5673	0.5479	0.5286
1	0	1	1	0	0	1	1	12,749.30	0.52780	0.00411	0.54336	0.5434	0.5395	0.5356	0.5317	0.5278
1	0	1	1	0	0	1	0	12,694.78	0.52982	0.00411	0.54336	0.5434	0.5400	0.5366	0.5332	0.5298
1	0	1	1	0	0	0	1	12,717.62	0.52898	0.00355	0.60592	0.6059	0.5867	0.5674	0.5482	0.5290
1	0	1	1	0	0	0	0	12,663.10	0.53100	0.00355	0.60592	0.6059	0.5872	0.5685	0.5497	0.5310
1	0	1	0	1	1	1	1	12,879.12	0.52300	0.00413	0.54114	0.5411	0.5366	0.5321	0.5275	0.5230
1	0	1	0	1	1	1	0	12,824.61	0.52501	0.00413	0.54114	0.5411	0.5371	0.5331	0.5290	0.5250
1	0	1	0	1	1	0	1	12,847.44	0.52417	0.00357	0.60370	0.6037	0.5838	0.5639	0.5441	0.5242
1	0	1	0	1	1	0	0	12,792.93	0.52619	0.00357	0.60370	0.6037	0.5843	0.5649	0.5456	0.5262
1	0	1	0	1	0	1	1	12,815.00	0.52537	0.00413	0.54114	0.5411	0.5372	0.5333	0.5293	0.5254
1	0	1	0	1	0	1	0	12,760.49	0.52739	0.00413	0.54114	0.5411	0.5377	0.5343	0.5308	0.5274
1	0	1	0	1	0	0	1	12,783.32	0.52654	0.00357	0.60370	0.6037	0.5844	0.5651	0.5458	0.5265
1	0	1	0	1	0	0	0	12,728.81	0.52856	0.00357	0.60370	0.6037	0.5849	0.5661	0.5473	0.5286
1	0	1	0	0	1	1	1	12,767.78	0.52712	0.00411	0.54336	0.5434	0.5393	0.5352	0.5312	0.5271
1	0	1	0	0	1	1	0	12,713.27	0.52914	0.00411	0.54336	0.5434	0.5398	0.5362	0.5327	0.5291
1	0	1	0	0	1	0	1	12,736.10	0.52829	0.00355	0.60592	0.6059	0.5865	0.5671	0.5477	0.5283
1	0	1	0	0	1	0	0	12,681.59	0.53031	0.00355	0.60592	0.6059	0.5870	0.5681	0.5492	0.5303
1	0	1	0	0	0	1	1	12,703.66	0.52949	0.00411	0.54336	0.5434	0.5399	0.5364	0.5330	0.5295
1	0	1	0	0	0	1	0	12,649.15	0.53151	0.00411	0.54336	0.5434	0.5404	0.5374	0.5345	0.5315
1	0	1	0	0	0	0	1	12,671.98	0.53067	0.00355	0.60592	0.6059	0.5871	0.5683	0.5495	0.5307
1	0	1	0	0	0	0	0	12,617.47	0.53269	0.00355	0.60592	0.6059	0.5876	0.5693	0.5510	0.5327
1	0	0	1	1	1	1	1	12,745.23	0.52795	0.00124	0.86218	0.8622	0.7786	0.6951	0.6115	0.5280
1	0	0	1	1	1	1	0	12,690.71	0.52997	0.00124	0.86218	0.8622	0.7791	0.6961	0.6130	0.5300
1	0	0	1	1	1	0	1	12,713.55	0.52913	0.00068	0.92474	0.9247	0.8258	0.7269	0.6280	0.5291
1	0	0	1	1	1	0	0	12,659.03	0.53115	0.00068	0.92474	0.9247	0.8263	0.7279	0.6295	0.5311
1	0	0	1	1	0	1	1	12,681.10	0.53033	0.00124	0.86218	0.8622	0.7792	0.6963	0.6133	0.5303
1	0	0	1	1	0	1	0	12,626.59	0.53235	0.00124	0.86218	0.8622	0.7797	0.6973	0.6148	0.5323
1	0	0	1	1	0	0	1	12,649.42	0.53150	0.00068	0.92474	0.9247	0.8264	0.7281	0.6298	0.5315
1	0	0	1	1	0	0	0	12,594.91	0.53352	0.00068	0.92474	0.9247	0.8269	0.7291	0.6313	0.5335
1	0	0	1	0	1	1	1	12,633.89	0.53208	0.00122	0.86440	0.8644	0.7813	0.6982	0.6152	0.5321
1	0	0	1	0	1	1	0	12,579.38	0.53410	0.00122	0.86440	0.8644	0.7818	0.6992	0.6167	0.5341
1	0	0	1	0	1	0	1	12,602.21	0.53325	0.00066	0.92696	0.9270	0.8285	0.7301	0.6317	0.5333
1	0	0	1	0	1	0	0	12,547.70	0.53527	0.00066	0.92696	0.9270	0.8290	0.7311	0.6332	0.5353
1	0	0	1	0	0	1	1	12,569.77	0.53445	0.00122	0.86440	0.8644	0.7819	0.6994	0.6169	0.5345
1	0	0	1	0	0	1	0	12,515.26	0.53647	0.00122	0.86440	0.8644	0.7824	0.7004	0.6185	0.5365
1	0	0	1	0	0	0	1	12,538.09	0.53563	0.00066	0.92696	0.9270	0.8291	0.7313	0.6335	0.5356
1	0	0	1	0	0	0	0	12,483.58	0.53765	0.00066	0.92696	0.9270	0.8296	0.7323	0.6350	0.5376
1	0	0	0	1	1	1	1	12,699.59	0.52964	0.00124	0.86218	0.8622	0.7790	0.6959	0.6128	0.5296
1	0	0	0	1	1	1	0	12,645.08	0.53166	0.00124	0.86218	0.8622	0.7796	0.6969	0.6143	0.5317
1	0	0	0	1	1	0	1	12,667.91	0.53082	0.00068	0.92474	0.9247	0.8263	0.7278	0.6293	0.5308
1	0	0	0	1	1	0	0	12,613.40	0.53284	0.00068	0.92474	0.9247	0.8268	0.7288	0.6308	0.5328
1	0	0	0	1	0	1	1	12,635.47	0.53202	0.00124	0.86218	0.8622	0.7796	0.6971	0.6146	0.5320
1	0	0	0	1	0	1	0	12,580.96	0.53404	0.00124	0.86218	0.8622	0.7801	0.6981	0.6161	0.5340
1	0	0	0	1	0	0	1	12,603.79	0.53319	0.00068	0.92474	0.9247	0.8269	0.7290	0.6311	0.5332
1	0	0	0	1	0	0	0	12,549.28	0.53521	0.00068	0.92474	0.9247	0.8274	0.7300	0.6326	0.5352
1	0	0	0	0	1	1	1	12,588.26	0.53377	0.00122	0.86440	0.8644	0.7817	0.6991	0.6164	0.5338
1	0	0	0	0	1	1	0	12,533.75	0.53579	0.00122	0.86440	0.8644	0.7822	0.7001	0.6179	0.5358
1	0	0	0	0	1	0	1	12,556.58	0.53494	0.00066	0.92696	0.9270	0.8290	0.7310	0.6329	0.5349
1	0	0	0	0	1	0	0	12,502.07	0.53696	0.00066	0.92696	0.9270	0.8295	0.7320	0.6345	0.5370
1	0	0	0	0	0	1	1	12,524.14	0.53614	0.00122	0.86440	0.8644	0.7823	0.7003	0.6182	0.5361
1	0	0	0	0	0	1	0	12,469.62	0.53816	0.00122	0.86440	0.8644	0.7828	0.7013	0.6197	0.5382
1	0	0	0	0	0	0	1	12,492.46	0.53732	0.00066	0.92696	0.9270	0.8295	0.7321	0.6347	0.5373
1	0	0	0	0	0	0	0	12,437.94	0.53934	0.00066	0.92696	0.9270	0.8301	0.7331	0.6362	0.5393

Risk Scenarios for 70-100% ML (1 ="Occur"; 0 ="No")								Single Consequence Data				w_{TC} = 0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LoL}	$v(X_{LoL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	1	1	1	1	1	1	1	621.34	0.97699	0.00347	0.61418	0.6142	0.7049	0.7956	0.8863	0.9770
0	1	1	1	1	1	1	0	566.82	0.97901	0.00347	0.61418	0.6142	0.7054	0.7966	0.8878	0.9790
0	1	1	1	1	1	0	1	589.66	0.97816	0.00291	0.67674	0.6767	0.7521	0.8274	0.9028	0.9782
0	1	1	1	1	1	0	0	535.14	0.98018	0.00291	0.67674	0.6767	0.7526	0.8285	0.9043	0.9802
0	1	1	1	1	0	1	1	557.21	0.97936	0.00347	0.61418	0.6142	0.7055	0.7968	0.8881	0.9794
0	1	1	1	1	0	1	0	502.70	0.98138	0.00347	0.61418	0.6142	0.7060	0.7978	0.8896	0.9814
0	1	1	1	1	0	0	1	525.53	0.98054	0.00291	0.67674	0.6767	0.7527	0.8286	0.9046	0.9805
0	1	1	1	1	0	0	0	471.02	0.98255	0.00291	0.67674	0.6767	0.7532	0.8296	0.9061	0.9826
0	1	1	1	0	1	1	1	510.00	0.98111	0.00345	0.61640	0.6164	0.7076	0.7988	0.8899	0.9811
0	1	1	1	0	1	1	0	455.49	0.98313	0.00345	0.61640	0.6164	0.7081	0.7998	0.8914	0.9831
0	1	1	1	0	1	0	1	478.32	0.98228	0.00289	0.67896	0.6790	0.7548	0.8306	0.9065	0.9823
0	1	1	1	0	1	0	0	423.81	0.98430	0.00289	0.67896	0.6790	0.7553	0.8316	0.9080	0.9843
0	1	1	1	0	0	1	1	445.88	0.98349	0.00345	0.61640	0.6164	0.7082	0.7999	0.8917	0.9835
0	1	1	1	0	0	1	0	391.37	0.98550	0.00345	0.61640	0.6164	0.7087	0.8010	0.8932	0.9855
0	1	1	1	0	0	0	1	414.20	0.98466	0.00289	0.67896	0.6790	0.7554	0.8318	0.9082	0.9847
0	1	1	1	0	0	0	0	359.69	0.98668	0.00289	0.67896	0.6790	0.7559	0.8328	0.9097	0.9867
0	1	1	0	1	1	1	1	575.70	0.97868	0.00347	0.61418	0.6142	0.7053	0.7964	0.8876	0.9787
0	1	1	0	1	1	1	0	521.19	0.98070	0.00347	0.61418	0.6142	0.7058	0.7974	0.8891	0.9807
0	1	1	0	1	1	0	1	544.02	0.97985	0.00291	0.67674	0.6767	0.7525	0.8283	0.9041	0.9799
0	1	1	0	1	1	0	0	489.51	0.98187	0.00291	0.67674	0.6767	0.7530	0.8293	0.9056	0.9819
0	1	1	0	1	0	1	1	511.58	0.98105	0.00347	0.61418	0.6142	0.7059	0.7976	0.8893	0.9811
0	1	1	0	1	0	1	0	457.07	0.98307	0.00347	0.61418	0.6142	0.7064	0.7986	0.8908	0.9831
0	1	1	0	1	0	0	1	479.90	0.98223	0.00291	0.67674	0.6767	0.7531	0.8295	0.9059	0.9822
0	1	1	0	1	0	0	0	425.39	0.98424	0.00291	0.67674	0.6767	0.7536	0.8305	0.9074	0.9842
0	1	1	0	0	1	1	1	464.37	0.98280	0.00345	0.61640	0.6164	0.7080	0.7996	0.8912	0.9828
0	1	1	0	0	1	1	0	409.86	0.98482	0.00345	0.61640	0.6164	0.7085	0.8006	0.8927	0.9848
0	1	1	0	0	1	0	1	432.69	0.98397	0.00289	0.67896	0.6790	0.7552	0.8315	0.9077	0.9840
0	1	1	0	0	1	0	0	378.18	0.98599	0.00289	0.67896	0.6790	0.7557	0.8325	0.9092	0.9860
0	1	1	0	0	0	1	1	400.25	0.98518	0.00345	0.61640	0.6164	0.7086	0.8008	0.8930	0.9852
0	1	1	0	0	0	1	0	345.73	0.98720	0.00345	0.61640	0.6164	0.7091	0.8018	0.8945	0.9872
0	1	1	0	0	0	0	1	368.57	0.98635	0.00289	0.67896	0.6790	0.7558	0.8327	0.9095	0.9863
0	1	1	0	0	0	0	0	314.05	0.98837	0.00289	0.67896	0.6790	0.7563	0.8337	0.9110	0.9884
0	1	0	1	1	1	1	1	441.81	0.98364	0.00058	0.93522	0.9352	0.9473	0.9594	0.9715	0.9836
0	1	0	1	1	1	1	0	387.30	0.98566	0.00058	0.93522	0.9352	0.9478	0.9604	0.9730	0.9857
0	1	0	1	1	1	0	1	410.13	0.98481	0.00002	0.99778	0.9978	0.9945	0.9913	0.9881	0.9848
0	1	0	1	1	1	0	0	355.62	0.98683	0.00002	0.99778	0.9978	0.9950	0.9923	0.9896	0.9868
0	1	0	1	1	0	1	1	377.69	0.98601	0.00058	0.93522	0.9352	0.9479	0.9606	0.9733	0.9860
0	1	0	1	1	0	1	0	323.18	0.98803	0.00058	0.93522	0.9352	0.9484	0.9616	0.9748	0.9880
0	1	0	1	1	0	0	1	346.01	0.98718	0.00002	0.99778	0.9978	0.9951	0.9925	0.9898	0.9872
0	1	0	1	1	0	0	0	291.50	0.98920	0.00002	0.99778	0.9978	0.9956	0.9935	0.9913	0.9892
0	1	0	1	0	1	1	1	330.47	0.98776	0.00056	0.93744	0.9374	0.9500	0.9626	0.9752	0.9878
0	1	0	1	0	1	1	0	275.96	0.98978	0.00056	0.93744	0.9374	0.9505	0.9636	0.9767	0.9898
0	1	0	1	0	1	0	1	298.79	0.98893	0.00000	1.00000	1.0000	0.9972	0.9945	0.9917	0.9889
0	1	0	1	0	1	0	0	244.28	0.99095	0.00000	1.00000	1.0000	0.9977	0.9955	0.9932	0.9910
0	1	0	1	0	0	1	1	266.35	0.99014	0.00056	0.93744	0.9374	0.9506	0.9638	0.9770	0.9901
0	1	0	1	0	0	1	0	211.84	0.99215	0.00056	0.93744	0.9374	0.9511	0.9648	0.9785	0.9922
0	1	0	1	0	0	0	1	234.67	0.99131	0.00000	1.00000	1.0000	0.9978	0.9957	0.9935	0.9913
0	1	0	1	0	0	0	0	180.16	0.99333	0.00000	1.00000	1.0000	0.9983	0.9967	0.9950	0.9933
0	1	0	0	1	1	1	1	396.18	0.98533	0.00058	0.93522	0.9352	0.9477	0.9603	0.9728	0.9853
0	1	0	0	1	1	1	0	341.66	0.98735	0.00058	0.93522	0.9352	0.9483	0.9613	0.9743	0.9873
0	1	0	0	1	1	0	1	364.50	0.98650	0.00002	0.99778	0.9978	0.9950	0.9921	0.9893	0.9865
0	1	0	0	1	1	0	0	309.98	0.98852	0.00002	0.99778	0.9978	0.9955	0.9932	0.9908	0.9885
0	1	0	0	1	0	1	1	332.05	0.98770	0.00058	0.93522	0.9352	0.9483	0.9615	0.9746	0.9877
0	1	0	0	1	0	1	0	277.54	0.98972	0.00058	0.93522	0.9352	0.9488	0.9625	0.9761	0.9897
0	1	0	0	1	0	0	1	300.37	0.98888	0.00002	0.99778	0.9978	0.9956	0.9933	0.9911	0.9889
0	1	0	0	1	0	0	0	245.86	0.99089	0.00002	0.99778	0.9978	0.9961	0.9943	0.9926	0.9909
0	1	0	0	0	1	1	1	284.84	0.98945	0.00056	0.93744	0.9374	0.9504	0.9634	0.9764	0.9895
0	1	0	0	0	1	1	0	230.33	0.99147	0.00056	0.93744	0.9374	0.9509	0.9645	0.9780	0.9915
0	1	0	0	0	1	0	1	253.16	0.99062	0.00000	1.00000	1.0000	0.9977	0.9953	0.9930	0.9906
0	1	0	0	0	1	0	0	198.65	0.99264	0.00000	1.00000	1.0000	0.9982	0.9963	0.9945	0.9926
0	1	0	0	0	0	1	1	220.72	0.99183	0.00056	0.93744	0.9374	0.9510	0.9646	0.9782	0.9918
0	1	0	0	0	0	1	0	166.21	0.99384	0.00056	0.93744	0.9374	0.9515	0.9656	0.9797	0.9938
0	1	0	0	0	0	0	1	189.04	0.99300	0.00000	1.00000	1.0000	0.9982	0.9965	0.9947	0.9930
0	1	0	0	0	0	0	0	134.53	0.99502	0.00000	1.00000	1.0000	0.9988	0.9975	0.9963	0.9950

Risk Scenarios for 70-100% ML (1 = "Occur"; 0 = "No")								Single Consequence Data			w_{TC} =	0	0.25	0.5	0.75	1
Aircraft		Structural		HAZMAT		Other										
Yes	False	Yes	False	Yes	False	Yes	False	X_{TC} ($)	$v(X_{TC})$	X_{LOL}	$v(X_{LOL})$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$	$v(X_C)$
0	0	1	1	1	1	1	1	486.81	0.98197	0.00347	0.61418	0.6142	0.7061	0.7981	0.8900	0.9820
0	0	1	1	1	1	1	0	432.30	0.98399	0.00347	0.61418	0.6142	0.7066	0.7991	0.8915	0.9840
0	0	1	1	1	1	0	1	455.13	0.98314	0.00291	0.67674	0.6767	0.7533	0.8299	0.9065	0.9831
0	0	1	1	1	1	0	0	400.62	0.98516	0.00291	0.67674	0.6767	0.7538	0.8310	0.9081	0.9852
0	0	1	1	1	0	1	1	422.69	0.98434	0.00347	0.61418	0.6142	0.7067	0.7993	0.8918	0.9843
0	0	1	1	1	0	1	0	368.18	0.98636	0.00347	0.61418	0.6142	0.7072	0.8003	0.8933	0.9864
0	0	1	1	1	0	0	1	391.01	0.98552	0.00291	0.67674	0.6767	0.7539	0.8311	0.9083	0.9855
0	0	1	1	1	0	0	0	336.50	0.98754	0.00291	0.67674	0.6767	0.7544	0.8321	0.9098	0.9875
0	0	1	1	0	1	1	1	375.47	0.98609	0.00345	0.61640	0.6164	0.7088	0.8012	0.8937	0.9861
0	0	1	1	0	1	1	0	320.96	0.98811	0.00345	0.61640	0.6164	0.7093	0.8023	0.8952	0.9881
0	0	1	1	0	1	0	1	343.79	0.98727	0.00289	0.67896	0.6790	0.7560	0.8331	0.9102	0.9873
0	0	1	1	0	1	0	0	289.28	0.98929	0.00289	0.67896	0.6790	0.7565	0.8341	0.9117	0.9893
0	0	1	1	0	0	1	1	311.35	0.98847	0.00345	0.61640	0.6164	0.7094	0.8024	0.8955	0.9885
0	0	1	1	0	0	1	0	256.84	0.99049	0.00345	0.61640	0.6164	0.7099	0.8034	0.8970	0.9905
0	0	1	1	0	0	0	1	279.67	0.98964	0.00289	0.67896	0.6790	0.7566	0.8343	0.9120	0.9896
0	0	1	1	0	0	0	0	225.16	0.99166	0.00289	0.67896	0.6790	0.7571	0.8353	0.9135	0.9917
0	0	1	0	1	1	1	1	441.18	0.98366	0.00347	0.61418	0.6142	0.7065	0.7989	0.8913	0.9837
0	0	1	0	1	1	1	0	386.66	0.98568	0.00347	0.61418	0.6142	0.7071	0.7999	0.8928	0.9857
0	0	1	0	1	1	0	1	409.50	0.98483	0.00291	0.67674	0.6767	0.7538	0.8308	0.9078	0.9848
0	0	1	0	1	1	0	0	354.98	0.98685	0.00291	0.67674	0.6767	0.7543	0.8318	0.9093	0.9869
0	0	1	0	1	0	1	1	377.05	0.98604	0.00347	0.61418	0.6142	0.7071	0.8001	0.8931	0.9860
0	0	1	0	1	0	1	0	322.54	0.98805	0.00347	0.61418	0.6142	0.7076	0.8011	0.8946	0.9881
0	0	1	0	1	0	0	1	345.37	0.98721	0.00291	0.67674	0.6767	0.7544	0.8320	0.9096	0.9872
0	0	1	0	1	0	0	0	290.86	0.98923	0.00291	0.67674	0.6767	0.7549	0.8330	0.9111	0.9892
0	0	1	0	0	1	1	1	329.84	0.98778	0.00345	0.61640	0.6164	0.7092	0.8021	0.8949	0.9878
0	0	1	0	0	1	1	0	275.33	0.98980	0.00345	0.61640	0.6164	0.7097	0.8031	0.8965	0.9898
0	0	1	0	0	1	0	1	298.16	0.98896	0.00289	0.67896	0.6790	0.7565	0.8340	0.9115	0.9890
0	0	1	0	0	1	0	0	243.65	0.99098	0.00289	0.67896	0.6790	0.7570	0.8350	0.9130	0.9910
0	0	1	0	0	0	1	1	265.72	0.99016	0.00345	0.61640	0.6164	0.7098	0.8033	0.8967	0.9902
0	0	1	0	0	0	1	0	211.21	0.99218	0.00345	0.61640	0.6164	0.7103	0.8043	0.8982	0.9922
0	0	1	0	0	0	0	1	234.04	0.99133	0.00289	0.67896	0.6790	0.7571	0.8351	0.9132	0.9913
0	0	1	0	0	0	0	0	179.53	0.99335	0.00289	0.67896	0.6790	0.7576	0.8362	0.9148	0.9934
0	0	0	1	1	1	1	1	307.28	0.98862	0.00058	0.93522	0.9352	0.9486	0.9619	0.9753	0.9886
0	0	0	1	1	1	1	0	252.77	0.99064	0.00058	0.93522	0.9352	0.9491	0.9629	0.9768	0.9906
0	0	0	1	1	1	0	1	275.60	0.98979	0.00002	0.99778	0.9978	0.9958	0.9938	0.9918	0.9898
0	0	0	1	1	1	0	0	221.09	0.99181	0.00002	0.99778	0.9978	0.9963	0.9948	0.9933	0.9918
0	0	0	1	1	0	1	1	243.16	0.99099	0.00058	0.93522	0.9352	0.9492	0.9631	0.9771	0.9910
0	0	0	1	1	0	1	0	188.65	0.99301	0.00058	0.93522	0.9352	0.9497	0.9641	0.9786	0.9930
0	0	0	1	1	0	0	1	211.48	0.99217	0.00002	0.99778	0.9978	0.9964	0.9950	0.9936	0.9922
0	0	0	1	1	0	0	0	156.97	0.99419	0.00002	0.99778	0.9978	0.9969	0.9960	0.9951	0.9942
0	0	0	1	0	1	1	1	195.95	0.99274	0.00056	0.93744	0.9374	0.9513	0.9651	0.9789	0.9927
0	0	0	1	0	1	1	0	141.43	0.99476	0.00056	0.93744	0.9374	0.9518	0.9661	0.9804	0.9948
0	0	0	1	0	1	0	1	164.27	0.99392	0.00000	1.00000	1.0000	0.9985	0.9970	0.9954	0.9939
0	0	0	1	0	1	0	0	109.75	0.99594	0.00000	1.00000	1.0000	0.9990	0.9980	0.9970	0.9959
0	0	0	1	0	0	1	1	131.82	0.99512	0.00056	0.93744	0.9374	0.9519	0.9663	0.9807	0.9951
0	0	0	1	0	0	1	0	77.31	0.99714	0.00056	0.93744	0.9374	0.9524	0.9673	0.9822	0.9971
0	0	0	1	0	0	0	1	100.14	0.99629	0.00000	1.00000	1.0000	0.9991	0.9981	0.9972	0.9963
0	0	0	1	0	0	0	0	45.63	0.99831	0.00000	1.00000	1.0000	0.9996	0.9992	0.9987	0.9983
0	0	0	0	1	1	1	1	261.65	0.99031	0.00058	0.93522	0.9352	0.9490	0.9628	0.9765	0.9903
0	0	0	0	1	1	1	0	207.14	0.99233	0.00058	0.93522	0.9352	0.9495	0.9638	0.9781	0.9923
0	0	0	0	1	1	0	1	229.97	0.99148	0.00002	0.99778	0.9978	0.9962	0.9946	0.9931	0.9915
0	0	0	0	1	1	0	0	175.46	0.99350	0.00002	0.99778	0.9978	0.9967	0.9956	0.9946	0.9935
0	0	0	0	1	0	1	1	197.53	0.99268	0.00058	0.93522	0.9352	0.9496	0.9640	0.9783	0.9927
0	0	0	0	1	0	1	0	143.02	0.99470	0.00058	0.93522	0.9352	0.9501	0.9650	0.9798	0.9947
0	0	0	0	1	0	0	1	165.85	0.99386	0.00002	0.99778	0.9978	0.9968	0.9958	0.9948	0.9939
0	0	0	0	1	0	0	0	111.34	0.99588	0.00002	0.99778	0.9978	0.9973	0.9968	0.9964	0.9959
0	0	0	0	0	1	1	1	150.31	0.99443	0.00056	0.93744	0.9374	0.9517	0.9659	0.9802	0.9944
0	0	0	0	0	1	1	0	95.80	0.99645	0.00056	0.93744	0.9374	0.9522	0.9669	0.9817	0.9965
0	0	0	0	0	1	0	1	118.63	0.99561	0.00000	1.00000	1.0000	0.9989	0.9978	0.9967	0.9956
0	0	0	0	0	1	0	0	64.12	0.99763	0.00000	1.00000	1.0000	0.9994	0.9988	0.9982	0.9976
0	0	0	0	0	0	1	1	86.19	0.99681	0.00056	0.93744	0.9374	0.9523	0.9671	0.9820	0.9968
0	0	0	0	0	0	1	0	31.68	0.99883	0.00056	0.93744	0.9374	0.9528	0.9681	0.9835	0.9988
0	0	0	0	0	0	0	1	54.51	0.99798	0.00000	1.00000	1.0000	0.9995	0.9990	0.9985	0.9980
0	0	0	0	0	0	0	0	0.00	1.00000	0.00000	1.00000	1.0000	1.0000	1.0000	1.0000	1.0000

Appendix E: Cost/Benefit Data

Manpower Available	Manpower Level	Contractor Cost (CC) ($)	$W_{TC} = 0$ ERM	$W_{TC} = 0.25$ ERM	$W_{TC} = 0.50$ ERM	$W_{TC} = 0.75$ ERM	$W_{TC} = 1$ ERM
10%	10%	0.00	0.69489	0.67615	0.65741	0.63866	0.61992
	20%	1,424.03	0.73243	0.71876	0.70509	0.69143	0.67776
	30%	2,848.05	0.78262	0.76598	0.74934	0.73269	0.71605
	40%	4,272.08	0.80775	0.78958	0.77141	0.75324	0.73507
	50%	5,696.11	0.83581	0.82003	0.80425	0.78847	0.77269
	60%	7,120.13	0.84163	0.83371	0.82579	0.81788	0.80996
	70%	8,544.16	0.84745	0.83807	0.82870	0.81933	0.80996
	80%	9,968.19	0.84745	0.83807	0.82870	0.81933	0.80996
	90%	11,392.21	0.84745	0.83807	0.82870	0.81933	0.80996
	100%	12,816.24	0.84745	0.83807	0.82870	0.81933	0.80996
20%	20%	0.00	0.73243	0.71876	0.70509	0.69143	0.67776
	30%	1,424.03	0.78262	0.76598	0.74934	0.73269	0.71605
	40%	2,848.05	0.80775	0.78958	0.77141	0.75324	0.73507
	50%	4,272.08	0.83581	0.82003	0.80425	0.78847	0.77269
	60%	5,696.11	0.84163	0.83371	0.82579	0.81788	0.80996
	70%	7,120.13	0.84745	0.83807	0.82870	0.81933	0.80996
	80%	8,544.16	0.84745	0.83807	0.82870	0.81933	0.80996
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	80%	7,120.13	0.84745	0.83807	0.82870	0.81933	0.80996
	90%	8,544.16	0.84745	0.83807	0.82870	0.81933	0.80996
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40%	40%	0.00	0.80775	0.78958	0.77141	0.75324	0.73507
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	100%	4,272.08	0.84745	0.83807	0.82870	0.81933	0.80996

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Vita

Captain Timothy (Damon) Dalby graduated from Grosse Pointe South High School in Grosse Pointe Farms, Michigan in 1996. He entered undergraduate studies at Michigan State University in East Lansing, Michigan where he graduated with a Bachelor of Science degree in Civil Engineering in May 2001. He was commissioned through the United States Air Force Reserved Officer Training Corps, Detachment 380 at Michigan State University.

His first assignment was the 7th Civil Engineer Squadron, Dyess Air Force Base, Texas. While stationed at Dyess, he deployed overseas twice. From December 2002 until August 2003, he was deployed as the J-4 Engineering Section's Plans Officer as part of Combined Joint Task Force – Horn of Africa based in Djibouti City, Djibouti. In September 2004, Captain Dalby was deployed to Kuwait City, Kuwait where he worked for 4 months in the 386th Expeditionary Civil Engineer Squadron's Engineering Flight. In August 2005, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to the 823rd RED HORSE Squadron located at Hurlburt Field, Florida.

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14. ABSTRACT

The United States Air Force (USAF) is currently experiencing a period of high operations tempo and overseas deployments have become frequent. These deployments will leave home installations short manned. Some amount of risk is incurred by the home installation as a result of the short manning. For an organization, such as an USAF Fire and Emergency Services (FES) flight, whose primary responsibility is the protection of life and property, the incurred risk could be catastrophic. Still no attempt has been made to quantify risk in terms of manpower for USAF FES flights.

The primary purpose of this research was to develop and validate a methodology to quantify risk in terms of manpower for FES flights. This research develops a decision tool to provide insight to FES Fire Chiefs on the risk associated with specific manpower decisions. The methodology was validated using data from Dyess Air Force Base FES flight. A secondary goal of the research was to determine a cost/benefit relationship between the risk level and the cost to backfill deployed firefighter positions with contract labor. The result was a decision tree model and pareto optimal graphs for the risk to manpower level and the cost/benefit relationship.

15. SUBJECT TERMS

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